

SCIENTIFIC AMERICAN

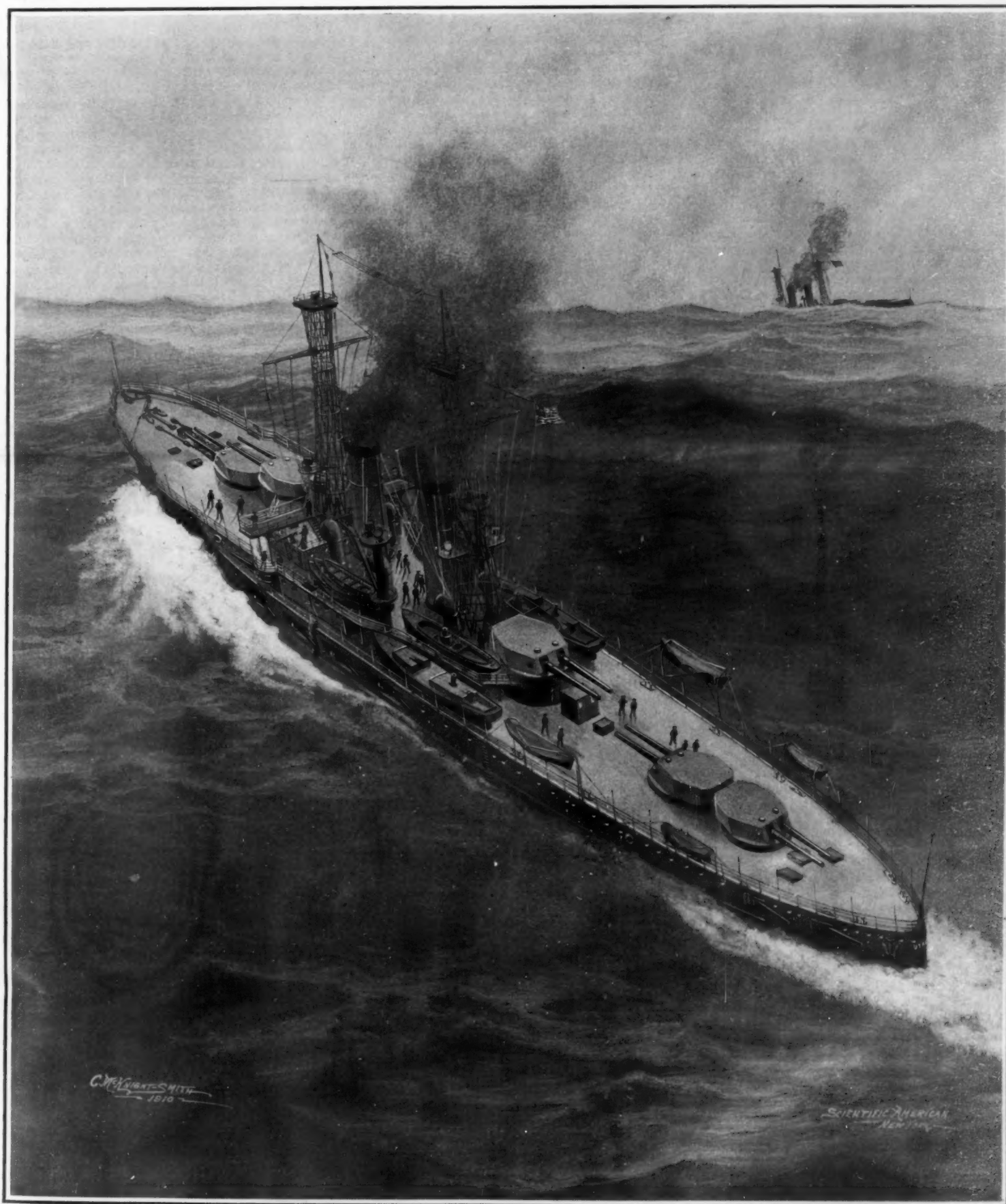
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A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CII. - No. 10.
ESTABLISHED 1845.

NEW YORK, MARCH 5, 1910.

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\$3.00 A YEAR.



Displacement, 21,825 tons. Speed, 30.75 knots. Coal, 2,500 tons. Oil fuel, 400 tons. Armor: Belt, 11 inches; turrets, 12 inches. Armament: Ten 12-inch; sixteen 5-inch guns. Torpedo tubes, two 21-inch. Complement, 1,014.

THE "UTAH"—OUR LATEST DREADNOUGHT.—[See page 199.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., Inc., Editors and Proprietors

Published Weekly at
No. 361 Broadway, New YorkCHARLES ALLEN MUNN, President
361 Broadway, New York
FREDERICK CONVERSE BLANCH, Sec'y and Treas.
361 Broadway, New York

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico \$3.00
One copy, one year, for Canada 4.75
One copy, one year, to any foreign country, postage prepaid, lbs. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) \$3.00 a year
Scientific American Supplement (established 1876) 5.00 "
American Homes and Gardens 5.00 "
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, MARCH 5th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A TRIBUTE TO AMERICAN SHIPBUILDING.

ALTHOUGH the general public has apparently failed to appreciate the significance of the recent winning of a \$22,000,000 order for battleships by an American shipbuilding firm in competition with the leading yards of Great Britain, France, Germany, and Italy, the importance of this matter is fully appreciated abroad.

The facts are as follows: About one year ago the Argentine government asked for proposals for two first-class battleships, and it requested four American firms and all the leading foreign shipbuilders to put in bids on the contract. The plans submitted were not accepted. The Argentine Commission then prepared its own specifications and asked bids from a selected number of these contractors. On the receipt of the second lot of bids it again narrowed the competition down to one American firm, the Fore River Company, two English firms, Vickers Sons & Maxim and the Armstrongs, and one company each from Germany, France, and Italy. As a result of this last competition the award was given to the Fore River Company on designs and price submitted by President Francis T. Bowles, formerly Chief Naval Constructor of the United States navy. One of these ships will be built at the Fore River yard, and the other by the New York Shipbuilding Company.

Judging from such particulars regarding the design of the vessels as are available, they will be the most powerful fighting ships afloat at the time of their launch. Although in displacement they will not exceed our two latest battleships, the "Wyoming" and "Arkansas," the disposition of their twelve 12-inch guns is such that they will have a considerably more powerful concentration of fire on every point of bearing except ahead. This advantage is secured by placing the two amidship turrets *en échelon*, or diagonally, an arrangement which permits the four guns in these turrets to be trained dead ahead or dead astern as may be desired. Since the four 12-inch guns in the pair of turrets in the bow and at the stern can be trained axially, this ship will be capable not only of concentrating all twelve guns on either broadside, as will be done by our new "Wyoming" class, but also eight guns dead ahead and eight dead astern as against a fire of four ahead and four astern for the "Wyoming." The belt is to be 16 inches in thickness, and the speed 22 knots. Apparently, unless some other features of the ship have been sacrificed, this vessel represents the highest development of offensive power yet attempted in the history of warship construction.

That the American tender was lower than that of such firms as Vickers and Armstrong is explained by the fact that armor plate and the steel for the hull construction can be obtained at a lower price in the United States than it can abroad, the difference in this regard being so great as to more than offset the high cost of American labor. Whatever be the reason for our success, the fact remains that the placing of this large contract with an American firm adds greatly to the prestige of our yards, and testifies to the high point of excellence to which warship construction has been carried in this country. In this connection we may as well draw attention to the fact that the apathy of the United States to any proposed measures for the resuscitation of our merchant marine has reduced the construction of merchant vessels to such a low point, that our leading shipbuilding yards are to-day kept alive almost entirely by government orders for work. Nor must it be argued that the securing of this large warship contract proves that there is no necessity for government assistance in the upbuilding of our merchant marine; for the question of the subsequent cost of running a merchant ship, which is much

higher in the American than in foreign service, does not enter into the consideration of warship construction. Moreover, the competition in the construction of merchant steamers is much keener, and the prices are relatively lower than for the construction of warships.

COULD THE EARTH COLLIDE WITH A COMET?

ON May 18th next the earth will be plunged into the tail of Halley's comet, and the head of that body will be but 15,000,000 miles away. It is but natural that a thinking man should ask: Is there a possibility that the earth may encounter a comet and thus come to a frightful end?

Curiously enough, it was Halley himself who first pointed out the possibility. Whiston, Newton's successor in the Lucasian chair of mathematics at Cambridge, was so alarmed at "a chariot of fire" which flared up in his day, that Halley was prompted to look closely into its movements. His work led to the startling result that the comet, when passing through the descending node, had approached the earth's path within a semi-diameter of the earth. Naturally, Halley wondered what would have happened had the earth and the comet been actually so close together in their respective orbits. Assuming the comet's mass to have been comparable with that of the earth (an assumption which we now know to have been utterly beyond reason) he concluded that their mutual gravitation would have caused a change in the position of the earth in its orbit, and consequently in the length of a year. This train of thought led him to consider what the result of an actual collision would have been, and he concludes that "if so large a body with so rapid a motion were to strike the earth—a thing by no means impossible—the shock might reduce this beautiful world to its original chaos."

Hence Halley not only dispelled the superstition and the terror which once followed in a comet's wake, but also pointed out a possibility which the superstitious Dark Ages had ever dreamed of. It seemed to Halley not improbable that the earth had at some remote period been struck by a comet which, coming upon it obliquely, had changed the position of the axis of rotation, the north pole having originally, he thought, been at a point not far from Hudson's Bay. The more recent investigations of Kelvin and Sir George Darwin completely upset any such theory.

Since Halley's time the chance of a collision between the earth and a comet has engaged the attention of many astronomical mathematicians. Laplace, for example, painted the possibility of a collision with the earth so vividly that he startled his day and generation. He drew a picture of a comet whose mass was such that a tidal wave some 13,000 or 14,000 feet high inundated the world, with the result that only the higher peaks of the Himalayas and the Alps protruded. Lalande created a panic by a similar consideration of the subject in a paper which was intended for presentation before the Academy of Sciences, but which was not read. Such was the popular excitement, that he felt himself constrained to allay the public fears as well as he could in a soothing article published in the *Gazette de France*. The masses assumed by both Laplace and Lalande are so preposterous that their theories are no longer seriously considered by any sane astronomer.

Since the day of Laplace and Lalande there have been several comet "scares." Biela's comet crossed the earth's orbit on October 29th, 1832. When that fact was announced, Europe was in a ferment. The orbit of the earth was confused with the earth itself. Such was the popular excitement, that Arago took it upon himself to compute the possibilities of a collision. He pointed out that the earth did not reach the exact spot where the comet had intersected the earth's orbit until a month later, on November 30th, on which date the comet was 60,000,000 miles away. Incidentally he pointed out that a collision was always happily remote. He thought that the chances of a meeting were about one in 281,000,000. Babinet, on the other hand, thought that a collision was likely to take place once in about 15,000,000 years. More recently the entire problem has been considered by Prof. W. H. Pickering of Harvard. By a collision he understands, first, that any part of the earth strikes any part of the comet's head; second, that any part of the earth strikes the most condensed point in the head (the core) as distinguished from the larger nucleus. What the average size of a visible comet's head may be, we have no means of knowing. Young estimates that for a telescope comet it averages from 40,000 to 100,000 miles in diameter. The head of the great comet of 1811 was 1,200,000 miles; that of Holme's comet in 1892, 700,000 miles; and that of naked eye comets generally over 100,000 miles.

In the last half of the last century 121 comets, including returns, penetrated the sphere of the earth's orbit. From this Prof. Pickering infers that we should expect to be struck by the core of a visible comet once in about 40,000,000 years, and by some portion of the head once in 4,000,000 years. Since comets' orbits are more thickly distributed near the ecliptic than in other

regions of the sphere, the collisions would occur rather more frequently than this, but hardly as often as once in 2,000,000 years; and since it has been estimated that animal life has existed upon the earth for about 100,000,000 years, a considerable number of collisions, perhaps as many as fifty, must have taken place during that interval, in Prof. Pickering's opinion, evidently without producing any very serious results.

The old notions of the tidal effects of comets were based upon an erroneous conception of cometary masses. It seems astonishing that a man of Laplace's wonderful mathematical powers should not have concluded that a body like a comet, which can sweep through the entire solar system without deranging a single one of its members, must have a mass so small that it cannot appreciably affect the waters of the earth. As it is, comets are more likely to be captured by planets (witness the comet families of Jupiter and Saturn) than to derange a member of the solar system or to produce tidal effects.

The plunging of the earth in the tail of Halley's comet naturally causes many to wonder what will be the effect upon the inhabitants of the earth. Similar passages occurred in 1819 and 1861, but no one was the wiser until long after. Some astronomers claimed to have noticed auroral glares and meteoric displays at the time, but whether these were really associated with the comet or not cannot definitely be stated. At all events, it may be safely held that on May 18th next none of us will be aware of the fact that we are literally breathing the tail of Halley's comet. From this it may well be inferred that the wild tales of the possible effects of poisonous gases, tales for which the newspapers are very largely responsible, are utterly without foundation. It is true that a comet's tail is composed of poisonous and asphyxiating hydrocarbon vapors and of cyanogen; but it is also true that the actual amount of toxic vapor is so small that when the earth is brushed by the tail of Halley's comet, the composition of the atmosphere will not be so affected that a chemist could detect it. Flammarion has drawn a vivid picture in his "La Fin du Monde" of the possible effect of passing through a tail highly charged with vapors. He has shown us terrified humanity gasping for breath in its death struggle with carbon monoxide gas, killed off with merciful swiftness by cyanogen, and dancing joyously to an anæsthetic death, produced by the conversion of the atmosphere into nitrous oxide or dentist's "laughing gas." No one of any common sense should be alarmed by these nightmares, particularly when it is considered that so diaphanously thin is a comet's tail, that stars can be seen through it without diminution in brightness.

PATENT COMPLEXITIES IN GREAT BRITAIN.

IN the course of a judgment in an important patent case before the House of Lords, the supreme tribunal of Great Britain, the Lord Chancellor made very pointed references to the complexity with which patent specifications are sometimes encumbered. During the past few years there has been an increasing tendency to render such specifications as intricate and as voluminous as possible, thereby obscuring the vital issue. Only a few weeks previously the Chancellor complained in another action of the manner in which claim and narrative had been so intimately interwoven that considerable difficulty was experienced in unraveling the real factors in the issue. Such a tendency, the Lord Chancellor pointed out, defeated its own object; for where patent specifications and claims were so framed as to puzzle a student, business men were afraid to take out a license for its working, for fear their interpretation of the patent might be found to be erroneous, be found guilty of infringement, and be mulcted in heavy damages. The particular case in which the Lord Chancellor was constrained to make these comments was in connection with improvements in the casting and trimming of stereotype plates. The court contended that the specification of the original patent was extremely voluminous and complicated, amounting almost to the bulk of a treatise, in which there was infinite redundancy and repetitions, and constant references to illustrations which were somewhat difficult to follow. It was a document which needed a prolonged and penetrating study in order that anyone who wished to work out problems in this particular field of industry might know how to avoid all possible risk of infringement.

In the course of his remarks the Lord Chancellor pointed out that inventors who drew up such complicated claims must run the risk of the whole patent's being declared void by the court on the plea of ambiguity. The framing of specifications in this manner he declared to be an abuse of the law, and he gave the warning that it would be checked, if the occasion arose, by the simple process of declaring the patent invalid. These timely remarks have been greatly appreciated by British commercial and manufacturing establishments, and there is no doubt that advantage will be taken to draw up specifications in a more concise and lucid manner.

ENGINEERING.

The Chanute medal, founded by that celebrated engineer, Octave Chanute, and awarded by the Western Society of Engineers for the best paper presented during the year, has been given to Prof. Talbot, University of Illinois, for his paper entitled "Tests of Cast Iron and Reinforced Concrete Culvert Pipe," which embodied results of a research extending over a number of years.

The Interstate Commerce Commission points with pardonable pride to the saving of life and limb which has resulted from the operation of the safety appliance law. In 1893 one out of every 349 men employed in car coupling was killed, and one in 13 was injured; whereas in 1908, one out of 983 was killed, and one out of 62 was injured—an increase in the factor of safety against death of 181.6, and against injury of 377.

In addition to the three dreadnought battleships which are being built for the Brazilian navy, the programme of construction includes ten destroyers of the staunch seagoing type being built by Messrs. Yarrow. Six are in commission and the seventh recently exceeded her speed of 27 knots during trials on the Clyde, carrying a load of 100 tons. These vessels are 240 feet long and they are propelled by twin reciprocating engines of 8,000 horse-power.

Bion J. Arnold has been appointed subway engineer for the city of Chicago, and it is probable that about nine miles of subway will be put under construction forthwith. The city has sufficient funds for this purpose from its accumulation from the street railway company's dividends, and the street-car companies are bound to contribute \$5,000,000. The first section will be built in the heart of the city, and will form the center from which later construction will radiate.

There is much significance in the recent capture by the Germans of several big contracts in this country. The Rhenish-Westphalian works have contracted to build three more 10,000-horse-power turbines for the Niagara Falls power plants, which will make fifteen in all with a total horse-power of 150,000. Other German firms have obtained orders to build a series of large coke ovens for the Bethlehem Steel Company. The order includes 400 ovens with a capacity of 3,000 tons a day, and the cost will be about \$4,500,000.

There is much talk in the air about the construction of a 30,000-ton battleship for the United States navy, and its cause is to be found in the advent of the new and very powerful 14-inch gun, which recently underwent successful tests at Sandy Hook. If the 14-inch gun is to be installed, and the total number of guns is to remain the same as in the "Wyoming," an increase in displacement becomes necessary. Indeed, it is questionable whether even a 30,000-ton ship could mount twelve 14-inch guns and give them adequate protection.

Only those who have witnessed the great congestion on the present subway can understand the supreme satisfaction afforded by the determination of New York city's very efficient Mayor and the Public Service Commission to build at once an additional system of subways at a cost of \$100,000,000. The routes include an entirely new north and south subway from the Bronx to the Battery by way of Lexington Avenue and Broadway, and a subway in Brooklyn connecting the lines over the Williamsburg Bridge with the new Fourth Avenue route in Brooklyn, the latter to have elevated extensions to Fort Hamilton and Coney Island.

The Federal authorities have approved of plans for the opening of the Delaware River to a navigable depth of 12 feet as far as the city of Trenton, and it is believed that the development of deep-water navigation farther inland will be only a question of time. In Europe stupendous work of this character has been done. Manchester spent \$80,035,000 on the 35-mile canal, which has made the city of Manchester a seaport; while Duisberg in Germany, 100 miles from the mouth of the Rhine, and Cologne, 150 miles from the sea, are both in free communication by water with the seaboard.

Mr. George Gibbs, Chief Engineer of Electric Traction of the Pennsylvania Tunnel and Terminal Railroad, in a report made at the last session of the International Railway Congress gives some comparative figures of economy of the West Jersey and Seashore Railway and the Long Island Railroad on lines that were formerly operated by steam. During 1908 the Long Island Railroad operated its electric line at 17.80 cents per car mile as against a cost of 27.95 cents for steam train mileage. On the West Jersey and Seashore the costs were 20.46 cents for electric as against 22.30 cents for steam mileage. The relatively unfavorable results on the latter railway are accounted for mainly by the fact that stops were frequent on the steam service of the Long Island Railroad and the steam service therefore was costly; whereas on the West Jersey Road the average number of cars per steam train was twice that of the electric, and much of the service was express with few stops and therefore of an exceptionally economical character.

ELECTRICITY.

The first Edison medal of the American Institute of Electrical Engineers was awarded to Prof. Elihu Thomson for his achievements in electricity, on the occasion of the anniversary dinner of the Institute. This medal was founded by friends of Mr. Edison, and is intended to commemorate his work.

A remarkably long wireless transmission was recently recorded by the steamship "Tennessee," five days out from Honolulu, which succeeded in catching a message from Table Bluff on the coast of California. The message was a weather report, which was afterward verified by the Navy Department. The distance of transmission was 4,580 miles.

A recent test of wireless telephony was made to show its value for transmitting music. Several selections were sung in a transmitter at Park Avenue and Fortieth Street, New York, and were listened to by a group of newspaper men at the Metropolitan Tower. At times the singing was very clear, but frequently it was impossible to hear anything but a confused blur of sound.

A portable transformer drying apparatus has been devised to dry out transformers that have become moist during shipment or storage. The apparatus consists of a furnace adapted to burn wood or charcoal. A current of air heated by the furnace is forced through the transformer by means of a blower driven by a small motor. The air, before reaching the blower, is filtered through several thicknesses of cheesecloth.

The telephones used on the steamship "Lusitania" are quite interesting. The induction coil, condenser, and bell of the instrument are inclosed in a small white enamel box, and the switch hook which projects from one side is provided with a special retaining device to prevent the receiver from being knocked off by the motion of the ship. The receiver is allowed to rock on the hook, otherwise the lever would lift and make a false connection when the ship was pitching and rolling.

A recent number of the Electrical World describes a very interesting electrical installation on an Illinois farm. The power plant consists of a gas-producer installation supplying a 25-horse-power two-cylinder gas engine, to which a 16-kilowatt 125-volt direct-current generator is belted. The engine also runs a pump which supplies an elevated water tank. The current is used to light 150 lamps, which are used in the family residence and a tenant house, as well as in various barns, corn cribs, and other buildings.

A new type of long-distance telephone was recently tested successfully over a circuit extending from New York to Chicago, by way of Pittsburg, and return. The distance was 1,825 miles. The system, which is the invention of Dr. Tardieu of Arles, France, consists in raising the pitch of the message two octaves and a third by means of a combination of drums. At this high pitch the waves are sharp and short, and can be transmitted over a greater distance than is possible with the sound waves of ordinary conversation. At the receiver the pitch is again restored to normal.

At a recent meeting of the Institute of Electrical Engineers in London a differential electric thermometer was described by Prof. J. A. Fleming. The thermometer consists of two large glass tubes, sealed airtight at the top and bottom, and connected by a tube of fine bore in which is a thread of colored water containing a bubble of air in the center. The strips whose resistance is to be measured are placed in the tubes, and one of them is connected with a source of high-frequency current, while the other is connected with a source of direct current. By introducing resistance into the circuits, the heat may be regulated until it is the same in both tubes, as will be indicated by the bubble remaining in the center of the small connecting tube. The value of the resistances will vary inversely as the square of the current.

A report on the trackless trolley systems near Vienna has recently been made by the United States Consul-General there situated. The current collector used consists of a small frame supported on the grooved wheels which run on the positive and negative wires. The wheel is prevented from jumping the wires by a weighted pendulum. A cable of about 10 or 12 yards connects the current collector with the car. When two cars meet, the trolley connections are interchanged, and they can proceed on their way. This is an improvement over the track system with turn-outs at various points, which make it necessary for the first car that reaches the turn-out to wait until the second car arrives. The total running cost of this system for a car operating 75 miles a day is from \$5.20 to \$6.80, or from 7 to 9 cents per mile.

A five-mile test of the Edison-Beach storage battery car was made here last week over the 29th Street horse-car tracks. The car carried a number of engineers, who were to judge of its availability for street-car service in New York. If their decision is favorable, fifteen of the cars will be put into service.

SCIENCE.

Dr. E. E. Barnard of Yerkes Observatory secured photographs of Comet A 1910 on January 21st, 24th, and February 1st, 3rd, 4th, and 6th. Cloudy weather prevented the taking of any other photographs. Dr. Barnard informs us that one of the interesting features of this comet was an extension from the head about one-quarter of a degree long toward the sun. This extension was in a line with the prolongation of the southern edge of the tail.

The mechanical laboratory of the Polytechnic Institute of Worcester, Mass., has undertaken a study of the relative thermal conductivity of rolled copper and of copper deposited by electrolysis and not rolled. The conductivity of the rolled copper was found to exceed that of the electrolytic copper by 30 per cent. This is an interesting instance of the change in the internal structure of metals which is produced by mechanical treatment.

Cobalt and tin, in the liquid state, are miscible in all proportions, but solid cobalt dissolves only about 3½ per cent of tin. The two metals form two definite compounds, CoSn and Co₂Sn. Cobalt and antimony also mix in all proportions in the liquid state. Solid cobalt can take up 12½ per cent of antimony, with which it forms the compounds CoSb and Co₂Sb. Cobalt and lead form no definite solid compound and, even in the liquid state, each dissolves only a small quantity of the other. The same law governs the alloys of cobalt with bismuth and thallium. Cobalt and zinc, fused together, deposit alloys in which the definite compound CoZn, has been found. Cobalt and chromium mix in all proportions, in the solid as well as in the liquid. Cobalt and silicon mix in all proportions, in the liquid state, and form five definite solid compounds: Co₂Si, CoSi, Co₂Si₂, Co₃Si₂, Co₂Si₃. These recent determinations possess especial interest, as very little study has been given to the alloys of cobalt.

European sportsmen are beginning to fear that game will be made scarce by the multiplication of aeroplanes, balloons, and other aerial vessels. It is well known that where many kites are habitually flown they have the effect of driving the game to other districts. The effect of a kite, however, is very small in comparison with that of an aeroplane or a dirigible balloon. A German landowner, strolling over his estate, saw two black storks which had been standing, with a number of ducks, on the bank of a pond, suddenly take to flight, without apparent reason. The next instant the ducks, quacking loudly, took wing and were soon out of sight. Looking around for the cause of the birds' affright the proprietor saw a dirigible balloon, which the birds had probably perceived before it became visible to him. He learned afterward that deer, browsing in the fields, had been frightened by the sight of the airship or by the noise made by its propellers and had fled to the forest. All animals are terrified by airships. Partridges, quail, and other game birds crouch and hide, while domestic fowls utter loud warning notes the instant they perceive the monstrous bird of prey. The Swedish aeronaut Von Hoffman, while sailing at a moderate elevation, observed that elks, foxes, hares, and other wild animals fled at his approach, and that the dogs ran, howling, into the houses. While the "Zeppelin III." was going from Düsseldorf to Essen the aeronauts on board noted that horses and cattle galloped frantically over the fields on catching sight of the airship.

One of the scientific developments of recent years has been the formation of international organizations for the consideration of important subjects. International congresses in zoology, in chemistry, in medicine, and in other subjects meet at regular intervals, usually every three years, for the purpose of freely discussing the problems of their specialties. These have resulted in international committees. Thus it happens that there is an International Union for Solar Research, with a special committee on solar radiation. The desirability of establishing an international scale for the comparison of observations in solar radiation is obvious. It is fortunate that Mr. C. G. Abbot, director of the Smithsonian Astrophysical Observatory, has succeeded in perfecting the construction of an instrument used for such a purpose which is called "pyrheliometer." These instruments, tested by him both in Washington and at Mount Wilson in California, have been found to yield satisfactory results. A limited grant from the Hodgkins fund of the Smithsonian Institution was made for the construction of four of these silver disk pyrheliometers. These have now been completed and are about to be sent to investigators in widely separated localities for use in obtaining constants. The first of these instruments will be sent to M. Violle, who is chairman of the committee on solar radiation of the Solar Union, and by him will be placed in the meteorological station established by the French government on the Pic du Midi in the Pyrenees in the south of France. The second will go to M. Chistoni of the Physical Institution in Naples and will be sent to the observatory on Mount Vesuvius.

TWO REMARKABLE SHOWS

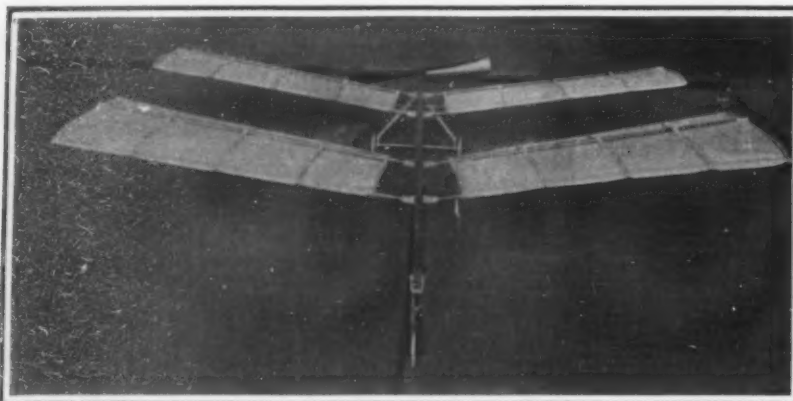
NOVELTIES IN MOTOR BOATS AND AEROPLANES

The sixth annual motor boat show to be held in Madison Square Garden opened on February 19th and lasted one week. The show this year was larger than ever before, there being a great number of boats of various speeds and sizes exhibited. These varied from 10 feet to 40 in length, and in motive power from 1 to 100 horse-power. Altogether, some fifty boats of various types were exhibited, representing a total value of \$250,000. The largest exhibit of any one firm was that of the Electric Launch Company of Bayonne,

N. J. In addition to an electric launch having a radius of 100 miles on one charge, this company showed a 21-foot mahogany yacht tender fitted with a 40-horse-power gasoline motor and capable of a speed of 22 miles an hour; a larger boat fitted with the same size motor and having a speed of 18 miles an hour; and a 35-foot craft fitted with a 6-cylinder 60-horse-power motor and capable of a speed of 23 miles per hour with six or eight passengers. The most pretentious "Elco" was a high-speed 54-foot cabin launch, fitted

with a 60-horse-power 4-cylinder Standard motor, and capable of a speed of 15 miles per hour. This boat has a large open cockpit fore and aft for fair weather, and a spacious cabin amidships. The engine is placed forward in a separate compartment, and the controlling levers and steering wheel are placed side by side. Other firms exhibited cruisers comparable in size to the boat just mentioned and fitted with all the conveniences needed on this type of craft.

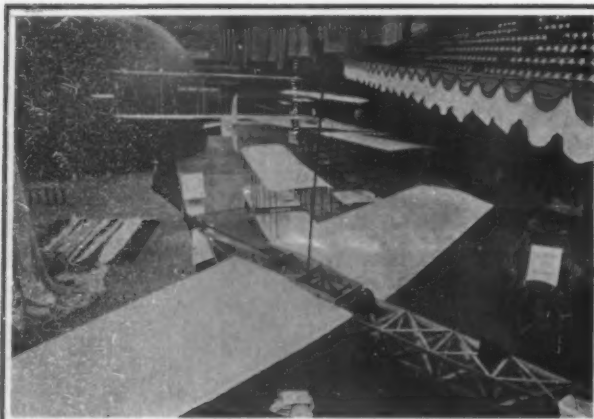
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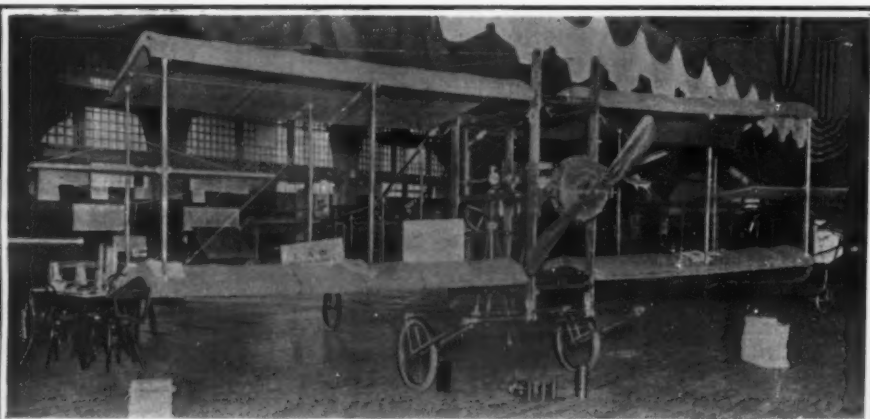
Paulhan's Langley type prize-winning model aeroplane.



General view of Boston Aeronautic Show; Monoplane Exhibit.



Interesting full-size Aeroplanes exhibited at the Boston Aeronautical Show.



The novel L. A. W. biplane, with its revolving cylinder, air-cooled, 2-cycle motor. The heavy curves and construction of the planes is a noticeable feature.

The Bench Antoinette type monoplane appears in the foreground and the Bartlingame monoplane in the semi-distance. The gliders are seen between these two machines, and the Herring biplane appears on the platform in the distance.



General view of the Sixth Annual Motor Boat Show in Madison Square Garden, New York.

TWO REMARKABLE SHOWS.—NOVELTIES IN MOTOR BOATS AND AEROPLANES.

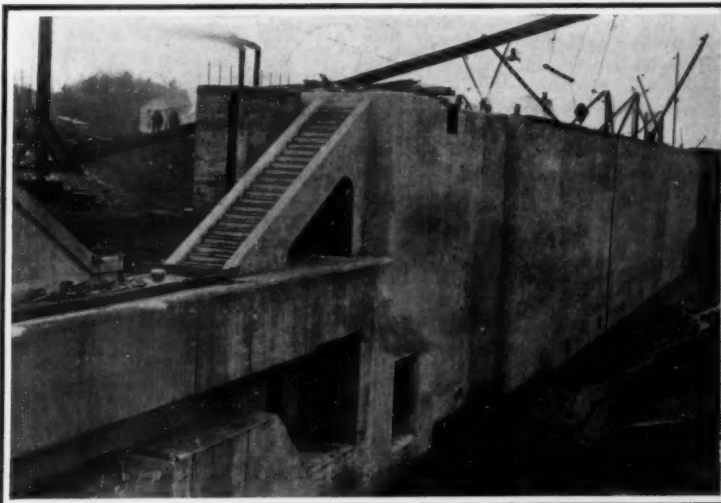
RAPID PROGRESS OF THE NEW YORK STATE BARGE CANAL

A RECORD OF RECENT ACHIEVEMENT

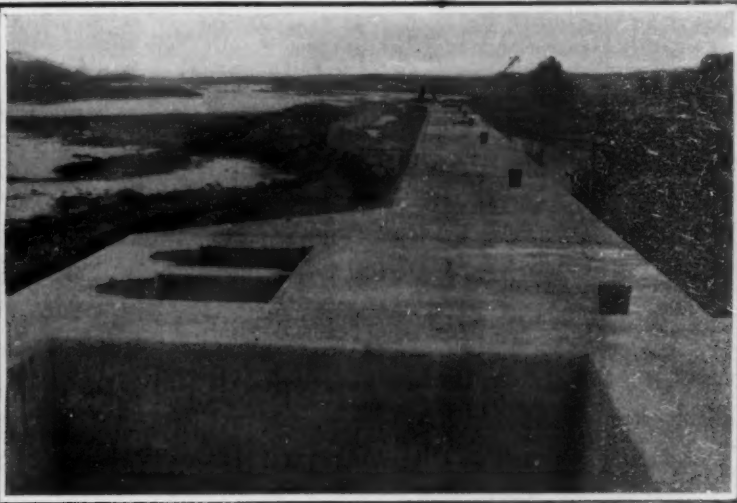
The large amount of work done on the New York State Barge Canal during the past year augurs well, not only for the completion of this great work within the contract time, but for its being done within the estimate of total cost of \$101,000,000. Almost as much construction work was completed during the

aggregate of the work under contract is \$54,138,329. It is satisfactory to know that this has been accomplished at a saving of \$2,653,208 over the estimate of 1903 for the same work. Construction work to the value of more than \$16,000,000 has been done, nearly one-half of it during the year 1909; fifteen out of the

ing Lake Erie at Buffalo at an elevation of 565.6 feet above sea level, the new canal follows the Niagara River to Tonawanda Creek and thence runs easterly to the Oswego River and to a junction with the Hudson River at Waterford. After entering Tonawanda Creek it follows the stream to Lockport, where a de-



View of lock No. 5 at Northumberland.



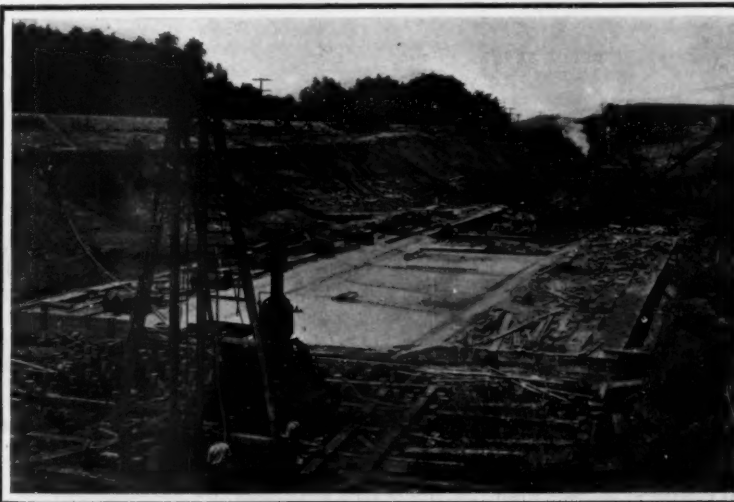
One wall of a lock, showing massive character of the concrete masonry.



Erecting the lock gates at lock No. 11 at Comstock.



A section of the completed canal at Miller.



Laying the concrete floor, lock No. 12 at Whitehall.



Another view of Comstock lock No. 11, showing retaining wall.

RAPID PROGRESS OF THE NEW YORK STATE BARGE CANAL.

year as was accomplished during the whole period of construction preceding, and the plans that were worked out to completion equal 80 per cent of the amount of similar work done in any previous two years; that is, if we consider the mileage and the size of the estimate.

On January 1st, 1910, some 314 miles of the canal, or 75 per cent of the entire work, were under contract; the remainder of the plans were nearing completion and will soon be ready for letting; and the

fifty-four locks are practically completed; and by the spring of next year the eight movable dams of the Mohawk River will be in operation. The work has now reached a stage where it is possible to predict both the time and cost of the completion of the entire project.

By studying the accompanying map, profile, and cross sections of the canal in connection with the following outline of its principal features, an adequate conception of this great work may be gathered. Leav-

scant of 103 feet is made by means of two locks; thence there is a 60-mile level to Rochester. Beyond Rochester the new canal coincides with the old canal until it enters the River Clyde near Lyons. Beyond Lyons the old canal route is abandoned and a new route is laid to the north of the old work. The Clyde River and the Seneca River are followed to Three Rivers, where the Seneca and Oneida unite to form the Oswego River. A new stretch of canal will be formed in the bed of the river, running north to Lake Ontario, the

depth of the river being increased by the use of fixed dams. From Oswego River the canal extends easterly, following the river to and across Oneida Lake, and through the valley of Wood Creek to the city of Rome. Here the canal crosses the divide by a series of locks and enters the valley of the Mohawk River.

The canal in the valley of the Mohawk between Utica and Schenectady will be provided with nine movable and two fixed dams; eight of the movable dams will have a maximum lift of 15 feet and a maximum depth on the sills of 20 feet; and these structures will serve to control the high floods of the Mohawk. The canal enters the Hudson River at Waterford by a series of five locks, which will bring it down from an elevation of plus 151 feet to tide level. From Waterford the important branch known as the Champlain Canal runs north to the lake. As far as Fort Edward the location lies in the Hudson River, and beyond Fort Edward it will be on an entirely new location, making entry into Lake Champlain through Wood Creek, which will be canalized by the use of fixed dams. The Canadian government has planned the construction of a waterway, with a depth of 12 feet, from the mouth of the new canal through Lake Champlain to Montreal.

Naturally, a work of this magnitude, passing through an undulating country and through several important cities, involves an immense amount of structural work in the way of dams, locks, bridges, and other masonry and steel work. There will be a total number of fifty-four locks, whose lift will vary from 6 feet to a maximum of 40½ feet, these taking the place of the seventy-two locks of the old canal. All of the locks will be 45 feet wide with a workable length of from 300 to 310 feet. The masonry work throughout the whole canal will be of concrete. All lock gates will be of steel, electrically operated. For the control of rivers and streams and the impounding of water for summit supply, there will be thirty-five dams of the fixed and movable types.

The total quantities of excavation and construction are necessarily very large, including in round numbers 58,000,000 cubic yards of dredging, 55,000,000 cubic yards of earth excavation, 11,000,000 cubic yards of rock excavation, and about 10,000,000 yards of embankment and back filling, making a total of about 133,000,000 cubic yards. In the masonry structures will be four and a quarter million cubic yards of concrete. The total length of the canal is 442 miles.

The Legislature in 1909 created a Canal Terminal Commission, whose task was to inspect the canal harbors connected with the Barge Canal, as well as harbors where canal freight is either shipped or delivered, and to report to the Legislature their findings. We hope to give a digest of this report in due course in the columns of this journal. In this connection it is of interest to note that the interest of the Federal government has been enlisted in the project to form a large terminal harbor in Jamaica Bay, with entrance channels at sufficient depth to accommodate seagoing vessels. This improvement will have an important bearing on the question of canal terminal facilities.

The Anthracite Coal Beds of Alaska.

By DAY ALLEN WILLEY.

The extent of its gold and copper deposits has given Alaska its principal reputation for mineral resources. The quality and area of these ores have called public attention to them to the neglect of other minerals, and the bulk of the mining in the territory has been done to secure these ores. Consequently coal mining and lumbering are practically undeveloped industries.

Although the geologist and mineralogist have been investigating in Alaska for a period of years, most of the work has been confined to the region along the coast and the territory traversed by navigable rivers such as the Yukon. Owing to the difficulty of examin-

ing and mapping the interior and especially the northern portion of Alaska, accurate information of its mineralogy is available in but a small fraction of its total area. Here, however, the study of the formation has been so thorough that the existence of very large deposits of coal has been revealed and accurate estimates made showing the locations of the veins, also the thickness, while the quality of the fuel has been carefully analyzed by elaborate tests. It may be added that the conclusions of the United States Geological Survey agree with the reports of experts who have been sent to Alaska to get data for mining and investment companies.

The investigation of the coal-bearing area has been largely centered in the vicinity of the coast, and two regions have been so thoroughly examined as to prove that fuel is another resource of Alaska of great importance. Though Tertiary coal-bearing rocks are known to cover a considerable area in the southern part of Admiralty Island and on adjacent islands of southeastern Alaska, the included coal of this region has little present fuel value. The beds are from a few inches to two or three feet in thickness, and the coal is of a low-grade lignitic character. There are two known areas of high-grade coal—the Bering River field, in the Controller Bay region, and the Matanuska field, north of Cook Inlet. The Bering River field, lying about 25 miles from tidewater at Controller Bay, embraces 2.64 square miles containing anthracite and 20.2 square miles bituminous coal. The coal-bearing rocks trend to the northeast into the unsurveyed high ranges, and it is quite possible that there may be an extension of the coal fields in this direction. Coal

square miles. Up to the present time there has been no means of transporting this coal to market, so that, as stated, no mining has been done, but many beds have been opened in prospecting.

The chemical analysis of specimens of coal taken from a large number of veins practically covering this entire district gives the following results:

	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulphur
Anthracite—					
Bering River, average of seven analyses	7.98	6.15	78.28	7.74	1.30
Matanuska River	2.55	7.08	84.32	6.05	0.57
Bituminous—					
Matanuska River, coking, average of sixteen analyses	2.71	20.23	65.39	11.60	0.57
Subbituminous—					
Matanuska River	6.56	35.43	49.44	8.57	0.37
Koyukuk River, one sample	4.47	34.32	48.36	12.95	—
Nation River, one sample	1.39	40.08	55.55	3.04	2.98
Alaska Peninsula, average of five analyses	2.34	38.68	49.75	9.22	1.07
Cape Lisburne, average of eleven analyses	9.35	38.01	47.19	5.45	0.35
Anaktuvuk River, one sample	6.85	36.39	43.38	13.38	0.54

Since the anthracite coal deposits of Pennsylvania would be naturally contrasted with Alaskan as a fuel element, some analyses of the more notable Pennsylvania grades may be given:

Pa. Region.	Water.	Volatile Hydrocarbon.	Fixed Carbon.	Fuel Ratio.	Ash.	Sulphur.
Wilkes-Barre.	2.40	4.54	83.97	19.38	8.55	0.65
Lehigh	1.72	3.52	88.00	5.66	0.61	—

A comparison of the analyses of the coal in the Matanuska field and the two regions yielding the high-

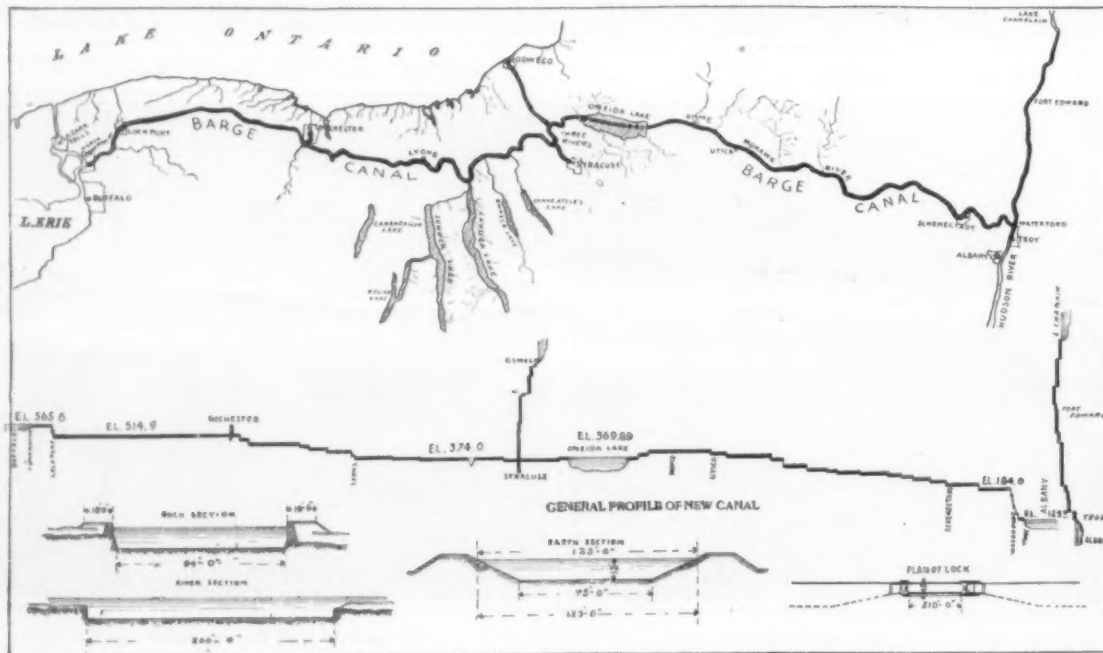
est grade of anthracite in Pennsylvania would indicate that the Alaskan is of slightly better quality for generating heat. Its percentage of fixed carbon, 84.32, is greater than the percentage in the Wilkes-Barre region, while the percentage of ash is 2.05 less than the other. The proportion of sulphur, 0.57, is the least in any anthracite coal found thus far in America.

While the area of the Matanuska region is limited in comparison with the Appalachian field, it is but a small area of the territory known by examination to contain deposits of anthracite and bituminous, many

available for use by the construction of railways. That Alaska contains great deposits of high-grade fuel is shown by an estimate of the beds in the southwestern section alone. On a conservative basis the total area of these fields is 957 square miles, and the area positively known to be underlain by coal embraces 85 square miles. The latest estimated area of the Pennsylvania anthracite region—the greatest producing region in the world for this grade—is 480 square miles. While the 957 square miles of southwest Alaska include also bituminous and lignite of a grade suitable for use, the lignite is contained in only about one-fifth of the area, or less than 200 square miles, the remainder representing bituminous and anthracite territory; but as already stated, the experts who have explored this region agree that the anthracite deposits that can be economically mined and made easily accessible by rail to seaports form a fuel resource of such proportions that it would supply Alaska and the Pacific States for an indefinite period.

The formation in the Matanuska is such that many of the veins can be reached by short tunnels without the need of vertical shafts, while the expense of elevating may also be avoided. The veins frequently outcrop on the surface. In short, the natural location permits mining at a minimum cost.

The beds referred to are not distant from the extensive copper mines located near the Copper River and exploited by the Guggenheim syndicate. In connection with this industry a railway 75 miles long has been completed to the coast at Cordova harbor for the purpose of making shipments to smelters in the States by water. The importance of the Matanuska coal has



Plan, profile, and sections of the New York State barge canal.

RAPID PROGRESS OF THE NEW YORK STATE BARGE CANAL.

beds varying from six to twenty feet in thickness are exposed in this region, with some local swellings, giving a much greater thickness. In quality the coals vary from an anthracite, with 84 per cent of fixed carbon, to a semi-bituminous with 74 per cent of fixed carbon, and include some varieties that will coke. There has been much prospecting in these coals, but in the absence of railways no mines have been developed, though a small output from one bed has been taken to the coast in barges.

The Matanuska may be considered the most important for commercial purposes thus far discovered in the territory, owing to its accessibility. This field lies about 25 miles from tidewater at Knik, a northerly embayment of Cook Inlet. As Cook Inlet is frozen during the winter, however, the distance to an open seaport must be measured to Resurrection Bay, on the east side of Kenai Peninsula, about 150 miles from the coal field. There are several months of the year when Cook Inlet could be used as a waterway.

The coal of these deposits as investigated by Alfred H. Brooks, the eminent mining expert associated with the Geological Survey, varies in quality from a sub-bituminous to a semi-bituminous, with some anthracite, and is included in folded and faulted Tertiary or Eocene shales, sandstones, and conglomerates, aggregating 3,000 feet in thickness. The coal beds vary from 5 to 36 feet in thickness, and the total area known to be underlain by coal aggregates 46½ square miles. However, as much of the field is covered by gravels and none of it has been surveyed in detail, the coal-bearing area may be much larger. The total area of what may prove to be coal-bearing rocks is approximately 900

caused the company to begin the building of a railroad to this field, as a route is available over which a railway can be easily constructed owing to the formation of the country. It will be about 175 miles in length. Another road has also been surveyed over the route already referred to, terminating at Resurrection Bay. This would allow water transportation at all seasons of the year because of the freedom from ice, while the depth of the bay is such that the largest ocean carriers can take on cargoes at the coal piers. Up to the present time this great coal field has been unproductive on account of no transportation facilities, the only operations being for test purposes. This region is of unusual interest at present owing to the Congressional investigation of the timber and mineral resources of the territory in connection with the Ballinger-Pinchot controversy.

Coal was found near Cook Inlet by the Russians as far back as 1855, but the entire output of the territory has been insignificant, as shown by the product of less than 10,000 tons of all kinds in 1909—none of it anthracite.

THE "UTAH"—OUR LATEST DREADNOUGHT.

The spirited drawing on the front page of this issue represents our latest dreadnought, the "Utah," recently launched from the yards of the New York Shipbuilding Company, Camden, N. J. She is shown steaming in a gale of wind against a heavy Atlantic sea; and, in spite of her great length of 521½ feet, the huge vessel, as she rides over the long Atlantic rollers, will do her full share of pitching and rolling as she climbs and descends each majestic sea. Several cable lengths to starboard is a sister ship that is running down the slope of a sea whose crest is sufficiently high to hide all but the funnels and masts.

These conditions are no mere creations of the artist's fancy; for we have recently seen a series of pictures taken on our fleet, when it was steaming northward in a heavy gale on the Pacific, in which only the tops of the funnels and the fighting masts of some of the vessels are visible, the ships lying deep in the trough of the waves.

But although the "Utah," in spite of her full load displacement of over 23,000 tons, will be to some extent the sport of the elements, her great weight and size will make her a far steadier gun platform than is afforded by the 16,000-ton "Connecticut" or the 12,000-ton "Maine"; and herein lies one of the most important advantages of the big over the medium-size warship. The "Utah," which is a sister ship to the "Florida," now nearing completion at the New York navy yard, is 521½ feet long, 88 feet 2½ inches wide, and on a normal displacement of 21,825 tons her draft is 28 feet 6 inches. At normal displacement, it should be explained, she will have a full supply of ammunition, and two-thirds of full supply of stores and fuel. The ship is an enlarged and improved "North Dakota," with 3 feet more beam, 1 foot 7 inches more draft, and 1,825 tons additional displacement. She is equipped with 4-screw Parsons turbines of 28,000 horsepower, which are designed to give her a contract speed of 20.75 knots. She will carry 2,500 tons of coal and 400 tons of oil fuel, and steam will be supplied by boilers of the Babcock & Wilcox type. The "Utah" will be manned by 60 officers and 954 men, her total complement being 1,014. This is about the number of men that were carried on the old wooden three-deckers of the largest size, and in this ship for the first time the crew of a modern battleship equals that of one of the olden days.

Like the "North Dakota" and "Delaware," the "Utah" carries ten 12-inch guns in the main battery. They are mounted in pairs in balanced turrets, the disposition of which is shown very clearly in our engraving of the ship. The foremost pair of guns has an elevation of about 33 feet above the normal waterline. The second pair has a command of about 40 feet. The guns of turret number 3 have a command of about 32 feet, and those in numbers 4 and 5 of about 25 feet. All of the guns being mounted on the center line, they can all be trained on either broadside. Dead ahead the "Utah" can fire four 12-inch guns, and the same number dead astern. It will thus be seen that maximum broadside fire is gained at the expense of end-on fire, for the "Minas Geraes," recently built for the Brazilian government, can fire eight guns ahead or astern, and the German and British battleships six guns. Most of the fighting, however, in all probability, will be done broadside to broadside; and the center line disposition, which originated in the Bureau of Construction and Repair, is probably the most effective that can be adopted.

The secondary battery consists of sixteen 50-caliber 5-inch guns. Eight of these are carried on the gun deck within a central battery; four aft on the same deck; two in sponsons upon the main deck just abaft of the bridge, and another pair on the same deck well forward toward the bow. This gives a broadside of eight 5-inch and an end-on fire of four 5-inch ahead and astern.

The protection of the hull, both below and above

water, and of the guns is exceptionally well worked out in these vessels, being in this respect an improvement even on the "North Dakota" herself, one of the best protected ships ever built. In the first place, with a view to limiting the destructive effects of a torpedo blow, particular attention has been paid to the question of cellular and compartmental subdivision. Even in the event of most serious underwater injury, such as might be done by a floating mine, the ship is able to concentrate on any compartment or set of compartments such a great capacity of pumps, that she would be able, by the aid of these alone, greatly to mitigate the effects of such a blow.

The armor plan of the "Utah" is probably the most complete and effective yet put upon any ship. The main belt, over 8 feet wide, has an average thickness amidship of 11 inches. Above this is a second belt 8 feet wide of an average thickness of 9 inches. The lower waterline belt is continuous from stem to stern, and the upper belt extends from the wake of the forward to the wake of the aftermost turret. The turrets of the 12-inch guns have from 12 to 8 inches of protection. The 5-inch secondary battery amidships is protected by 6½ inches of armor, and a similar thickness protects the casemates of the six guns at the bow and stern. Between each pair of 5-inch guns is a splinter bulkhead of 2-inch armor and back of each battery is a longitudinal wall of 3-inch armor, which closes in each 5-inch gun. To reach the base of the smokestacks any shell would have to pass through 9½ inches of armor—a superb protection.

It will be noted that the ship is provided with two of the new lattice-work fire-control masts with which all our latest ships have been equipped. The handling of the boats is done by two boat cranes placed abreast of each other, one on either side of the after smokestack. In this ship, as in all our dreadnoughts, the officers are berthed on the main deck forward below the forecabin deck, the crew accommodation being aft. This places the officers near the bridge and conveniently to their post of duty.

The keel of the "Utah" was laid March 15th, 1909, so that considerably less than a year has elapsed between the laying of the keel and the launch. In less than a year from the present time, if all goes well, this fine ship will have her trials, a speed in warship construction which is greatly to the credit of the New York Shipbuilding Company. Particular interest will attach to the trials of this vessel, for the reason that she will be the first of American battleships to be propelled by 4-screw Parsons turbines.

American Homes and Gardens for March.

The current number of American Homes and Gardens contains pictures of interesting California bungalows costing from \$1,000 upward; an article on the furnishing of the apartment by a well known author; an article on the interior decoration of the home, devoted to appropriate wall papers for the various rooms of the house; and views of a number of interesting houses, showing interiors, exteriors, and floor plans. The fourth prize garden of the American Homes and Gardens competition is also published in this issue, as well as garden notes devoted to fifteen good lilies. There is also an article on open-air orchard heating; and an article on the combined forcing bed and storage pit. One of the most interesting articles of the paper, one which is profusely illustrated, describes the water gardens of California. Trimming street and lawn trees, a timely subject, is well treated by an experienced writer. The historic mansions of the Rappahannock River are always interesting, and the illustrations of "Kenmore," the home of Betty Washington, is one of the important features of this number.

The Current Supplement.

The current SUPPLEMENT, No. 1783, contains an unusual number of timely and interesting articles. Dr. M. Wilhelm Meyer asks "What would we do if one of these days the sun were extinguished?" He considers the problem most instructively. Prof. O. N. Witt, the distinguished German chemist, contributes an article on the development of technological chemistry during the last forty years. An abstract is published from a paper read before the Society of Civil Engineers by M. Georges Claude on some interesting industrial applications of liquid air and oxygen. A most interesting equatorial telescope is in operation at the Urania-Zürich Observatory in Switzerland. This instrument is described by Mr. F. C. Perkins. Some photographs are reproduced which were taken by a photographer whom Latham recently took aloft with him at Lonservy, France. The pictures are probably the first ever published in this country taken from an aeroplane. Mr. Marconi's Nobel prize lecture on progress in wireless telegraphy is concluded. Lieut. John C. Soley, U. S. N., writes on the seismic period of 1909. As the result of investigations carried on during the last seventy-five years, it has become possible to establish on a firm basis criteria for instituting exact comparisons of the structure of the brain in the various groups of vertebrata. These criteria are discussed in an article entitled "The Evolution of the Brain."

Correspondence.

HOW TO MAKE THE "ALABAMA" AND "MAINE" IN10 PRE-DREADNOUGHTS.

To the Editor of the SCIENTIFIC AMERICAN:

As a reader of the SCIENTIFIC AMERICAN, I am particularly interested in the articles on the naval development.

I wish to know through your paper why the following changes would not be practical in remodeling the battleships "Idaho" and "Mississippi." Bearing in mind the results gained by adding 20 feet in length to the "Maine" class over the "Oklahoma's," which equals 948 tons displacement, 5,603-horse-power, 2 knots speed, 2 6-inch guns with ammunition, and 400 tons of coal.

I would cut these ships in two, just aft the boiler rooms, and build 30 feet, keeping as near the same beam as possible 77 feet. This 30 feet would be used almost entirely for boilers, engines and coal.

I think that another set of boilers could be installed, adding one-half to the boiler power. A new set of engines would have to be built to handle the 15,000-horse-power thus developed, and I think that the speed would be raised at least 1¼ knots, not much of an increase, but enough to allow these ships to steam with the 18-knot "Louisiana" class without reducing the speed of the whole fleet to 17 knots. I would replace the 8-inch guns with four 10-inch 45-caliber guns and add two 7-inch and four 3-inch guns to their present batteries. Thus we would have the following results:

Present.	Remodeled.
Length, 375 feet to.....	406 feet.
Beam, 77 feet to about.....	78½ feet
Displacement, 13,000 tons to about.....	14,500 tons
Horse-power, 10,000 to about.....	15,000 H. P.
Speed, 17 knots to about.....	18¼ knots
Bunker capacity, 1,750 tons to about.....	2,100 tons
Battery, 4 12-inch, 4 10-inch, 10 7-inch and 16 3-inch guns. The armor to remain the same as originally designed.	

This would be a rather costly change, but when a warship is needed the expense is a small item, and these two ships, with the increased speed and heavy batteries, would be a welcome addition to our first line of pre-dreadnoughts.

Chicago, Ill.

[Such changes as are suggested by our correspondent would be too costly for the benefits secured. It would not be possible to install four 10-inch guns—the weights of guns, turrets, etc., would be prohibitive. The money would give more fighting value if applied to entirely new ships of the dreadnought class.—Ed.]

Death of Prof. Amos E. Dolbear.

Prof. Dolbear died at Bedford, Mass., on February 23rd at the age of seventy-four. He was widely known as an inventor of electrical devices. Perhaps his investigations in wireless telegraphy brought him more into public prominence than any other, but the result was an infringement suit in which he unsuccessfully sought to restrain Marconi from continuing his experiments.

Prof. Dolbear took the degree of B.A. at Wesleyan University in 1866, and the degrees of M.A. and M.E. at the University of Michigan in 1867. From 1866 to 1867 he was instructor in Chemistry at the University of Michigan. Then he occupied the chair of Assistant Professor of Natural History at the University of Kentucky from 1867 to 1868. From 1868 to 1874 he was Professor of Physics and Chemistry at Bethany, W. Va. From 1874 to the time of his death he was Professor of Physics and Astronomy at Tufts College. His scientific investigations included the study of light and electrical phenomena; the properties of the ether; magnetic telephony; static telephony; heavy current ammeters; cables for telegraphic and telephonic work; wireless telegraphy; and the properties of matter.

Comet B 1910.

Prof. Pidox of Geneva Observatory, Switzerland, has cabled to Harvard College Observatory stating that he discovered a comet on February 20th in R. A. 0 h. 16 min. 22.1 sec. and Dec. +7 deg. 50 min. and 41 sec. The daily motion in right ascension was —22 min. 24 sec. and in declination —24 min. The new comet is not very far from Halley's comet. According to the corrected ephemeris of Crommelin the position of Halley's comet at the time was R. A. 0 h. 41 min. 29 sec. and Dec. +7 deg. 55 min.

According to Electrical Engineering, a definite proposal has been put forward for the construction of a tunnel between Denmark and Sweden, starting at Copenhagen, and connecting up with Malone. Connection would be made on the way with the small islands of Amager and Saltholm, and the electric trains which it is proposed to work through the tunnel would run on the surface on these islands, in order to reduce the underground journey as much as possible. If the scheme is carried out, it is estimated that the trip could be made in 1½ hour.



OSTRICH FARMING AS AN INDUSTRY

BY NEWTON FOREST



Does ostrich farming pay? The question is asked by almost everyone who visits an ostrich farm. The answer is that when an acre of alfalfa will furnish a home for four birds, with food enough to maintain them throughout the year; when an ostrich will yield annually about two pounds of feathers, with an average value of \$26 a pound, and from thirty-six to ninety eggs, which may be used for incubation, or may furnish food at the rate of nearly four pounds to the egg. If the owner does not wish to increase his troop, ostrich farming does pay, and pays well.

There is nothing very lovable about an ostrich, as there usually is about other domestic animals. But, however lacking in personal charm it may be, the big bird is a money producer. A head of cattle eats sixty-five pounds of alfalfa in a day; an ostrich, ten pounds. This head of cattle at five years old is worth \$40, and an ostrich at that age is worth \$250. There is nothing to the cattle but meat. At ten months the ostrich will produce \$10 worth of feathers, and thereafter from \$35 to \$150 worth of feathers annually for a long period of years. Though an ostrich is matured at the age of five and is reproducing, its average life is about that of a human being. The bird does not begin to decline until it is fifty years old. Many, however, produce fine plumage at the age of seventy-five.

There is as much difference in the breed of ostriches as there is in any other animal. Some of the California and Arizona male birds are rated at as high as \$5,000 each, but ordinarily the value averages about \$400 for a one-year-old bird and about \$100 for a chick. Some of the cocks weigh as much as 500 pounds and stand over ten feet high.

It has of late years been found that a great deal of money can be made in ostrich farming. Especially so where alfalfa or lucern can be raised on irrigated lands. In the Salt River Valley in Arizona there are about 250,000 acres of rich land, soon to be made richer and more productive through immense irrigation works on which the United States is spending \$6,000,000. Such a climate is an ideal one for ostrich farming, as the farms in that locality have already proven by their successful operations. While the birds thrive best in a warm, dry climate, they can be grown in any of the southern States and Territories of this country. In a moist climate, however, they would have to be protected from cold and rain.

It is only a little more than two decades ago since the first ostriches were brought into the United States with the serious purpose of attempting their culture

here. Before that time the only birds seen in this country had been adjuncts to circuses. To-day, exclusive of those in zoos, there are some four thousand birds on the American continent. Probably half of this number are the progeny of a single pair owned in Arizona in 1891.

The female ostrich matures much earlier than the cock, beginning to lay fertile eggs when she is about three and a half years old. The nest is nothing more or less than a hole scratched in the ground, which is done by the male bird. At first the hen may not take to the nest, but may lay her first eggs on the ground, whereupon the male will roll them into the nest. Generally, after the male has put three or four eggs into the nest, the female will take to it. She will then lay an egg every other day until about sixteen eggs have appeared in the nest. An ostrich egg is nearly eight inches long and about six inches in diameter. It makes a good omelet and is excellent when scrambled. One egg will make as much omelet as three dozen hens' eggs. A full-grown bird has been known to produce over three hundred pounds of egg food in a year.

An annual increase of about fifty per cent of a flock is secured mainly through the use of incubators, though on every farm a few paddocks are maintained, each for the sole occupancy of a pair of birds. Three times a year the hen begins to lay. She does most of her setting during the daytime, the male bird attending to that part of the household duties at night. He will usually go on the nest about five o'clock in the evening, and remain there until eight o'clock next morning. It is thought that the color of the sexes has something to do with developing these instincts. The male, being black, is not so easily seen at night, and the female, being drab or nearly the color of sand, cannot be readily observed on the nest in daytime. The male usually begins to sit three or four days before the hen stops laying. If the weather is cold during the laying period, the male will often be found covering the eggs at intervals during the night, to prevent them from becoming chilled. The birds are also very watchful in the warmest season to prevent the eggs from becoming superheated by the sun. The birds do this by resting on their ankle joints and spreading their wings umbrella-wise over the nest. As is usually the case with all eggs in a dry climate, the shell of an ostrich egg becomes dry and hard. It is therefore very difficult for the chick to break through. When the time arrives for the liberation of the young, they

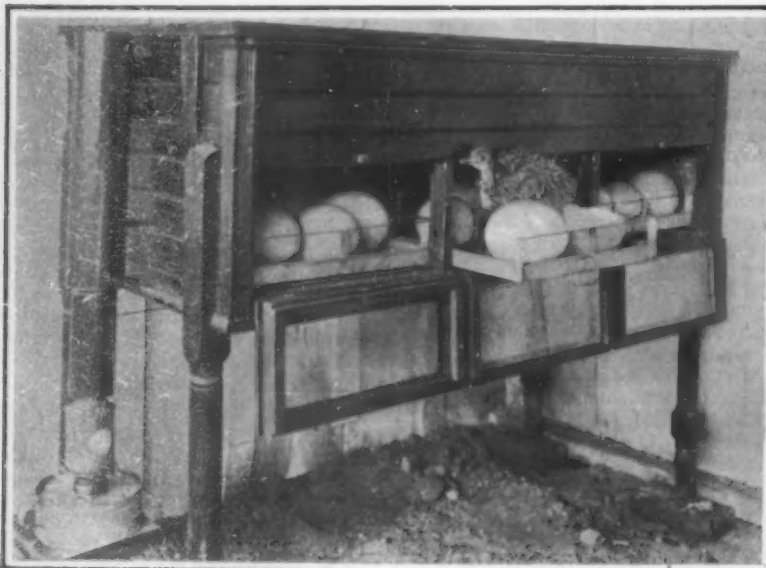
are heard to chirp and to move in the shell. The parent bird seems to understand the situation, and will often crack the shells with his breastbone, sometimes taking the young by the head and pulling it out of the shell. Sometimes four or five days elapse between the hatching of the first and the last egg. During this time one of the parent birds sticks to the nest while the other takes care of the chicks. However, on a well-regulated ostrich farm the farmer assists the birds in hatching by cracking the eggs with a small hammer and putting the unhatched eggs into an incubator.

The chicks appear to be all eyes and necks when they first come out of the shells, yet their bodies are as large as those of full-grown hens. They are as fuzzy and as soft as a day-old chicken, but far more stupid. For the first week of their existence nothing but gravel is given the young ostriches. Then they are turned into small pens in the alfalfa lots, where they are to eat alfalfa for the rest of their lives.

Plucking is the general term by which the harvesting of feathers is known. The term might lead one to believe that the feathers are pulled out. This is not the case, however, for that would injure the bird. The plumes are snipped off with shears close to the flesh. The quills that are left soon die and drop out, after which new feathers begin to sprout. There are twenty-five long white plumes on each wing of the cock bird. The rest of the plumage is black on the male and of a grayish color on the female. Gathering the feathers is no easy task. This work has to be done with great care, for a kick from one of the powerful legs of the bird is enough to disable a man for life or even kill him outright.

At the plucking time the birds are driven into individual plucking boxes, and a loose bag slipped over their heads, which tends to keep them quiet. A cock bird will roar mournfully while being plucked, although the operation is absolutely painless. After he has been stripped of his plumage, he is about as ugly a sight as one could behold.

The first experiment of ostrich farming in this country was made by an Englishman, who imported his birds from Africa and paid as high as \$1,200 a pair for them. As in nearly every venture of this character, the originator of the scheme did not make a fortune out of it. But the wise and daring investors who followed in his footsteps are now congratulating themselves. They are reaping the harvest no doubt dreamed of by the starter of the industry in California.



A male chick just hatched by an incubator.



Harvesting the feathers. The bird's head is covered.

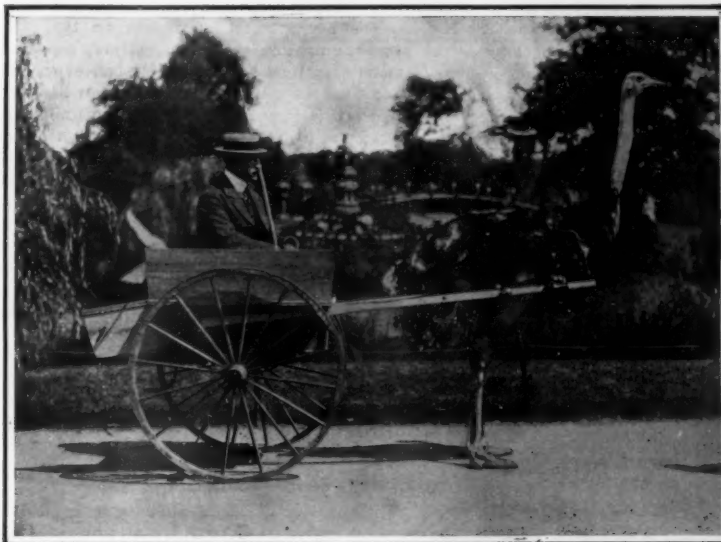
ronia. It is almost impossible for milliners to meet the demand for high-grade feathers, and if they were dependent solely on the stock imported from Africa, it would be quite out of the question. But so flourishing has been the American ostrich-farming industry, that a large part of the supply is now home product. The feathers produced in the United States are just as fine and in some cases much superior to those grown in Africa.

operation is done by French girls, and the skill with which this work is carried on is marvelous. To each flue on a long plume is tied another in such a way that the joint is invisible. Some plumes treated in this manner have been priced at \$1,000.

Elektron Metal: a New Light Weight Alloy.

At the International Aeronautical Exposition in Frankfort, a Griesheim firm exhibited a new and

The field of usefulness of the new material, therefore, is very extensive. Its strength and lightness make it especially valuable for the construction of airships and aeroplanes, but it may also be employed with advantage in the construction of automobiles, motors, and machines and instruments of every kind. It is so much stronger and lighter than aluminium and its alloys that 60 pounds of it may be substituted for 100 pounds of those materials. For example, in a Zeppelin



An ostrich-drawn cart.



A pair of birds and their eggs.

The business of ostrich farming has long become a science before it was introduced into this country. In South Africa there are all manner of laws to protect the business. There is a governmental ostrich doctor, whose particular duty it is to study the diseases peculiar to such birds. There is also an ostrich-breeding association where are recorded the pedigrees of the finer birds. Some of the farmers have so improved their stock that their ostrich chicks bring from \$500 to \$1,000 each, and many of the most noted cock birds are priced at \$7,000.

Port Elizabeth in South Africa is the chief ostrich-feather port of the world. In that vicinity there are nearly a half million birds now in captivity. The feathers from these birds sell from \$10 to \$150 a pound, and the industry of this one port alone amounts to some \$15,000,000 a year.

There are some districts that produce better feathers than others. The Oudtshoorn feather reaches twenty-

patented alloy, or series of alloys, under the name "elektron metal." These alloys possess great strength united to exceedingly low specific gravity, and hence appear to be the material of the future for various structural purposes. Aluminium and its alloys, the lightest metals now used in practice, are fifty per cent heavier than elektron metal, and far inferior to it in strength and tenacity. The new alloys are composed chiefly of magnesium, the rather inferior structural qualities of which metal have been very greatly improved by additions of various other metals. The alloys vary in specific gravity from 1.75 to 2.0, possess great strength, tenacity and elasticity, and are easily worked. They have a clear metallic ring and, when polished, a beautiful silvery luster. Their resistance to atmospheric influences satisfies every practical requirement, as they become covered with a protective film of oxide when exposed to the air. Even in the form of castings they show a tractile strength up to

airship having an aluminium frame weighing 12,000 pounds, 5,000 pounds weight could be saved without any reduction of strength by the substitution of elektron metal. It would then be possible to carry more fuel and ballast, increasing the radius of action, more passengers, or larger and more powerful motors. It may even be found possible to diminish the dimensions of the airship and the cost of operating it by an extensive employment of the new material. Similar advantages may be expected in automobile construction. A large automobile motor, for example, contains about 450 pounds of aluminium, which could be replaced by 275 pounds of elektron metal. At the exposition the new material was shown both cast and wrought into a great variety of forms.—Umschau.

The consumption of pulp wood during 1908 by 251 pulp mills in the United States amounted, according to a preliminary report of the Bureau of the Census,



The value of the 110 birds in this picture is at least \$50,000.

OSTRICH FARMING AS AN INDUSTRY.

nine and one-half inches in length, the Graff-Reinet measures about twenty-four inches, and the Middleburg runs twenty-two inches long. The last-named plume is considered just a little better than the Oudtshoorn, but of course all of these feathers are extremely rare and likewise expensive. The willow plume, the most expensive of the ostrich family, however, is a made plume. The length of the flue is acquired by tying extra flues to those already on the stem. This

more than 25,000 pounds per square inch, and an extensibility up to 5 per cent. By pressing, rolling and drawing, the tractile strength can be increased to very nearly 50,000 pounds per square inch, and the extensibility to 18 per cent, without producing any appreciable increase in specific gravity. The properties of the alloy can be varied within wide limits by varying the nature and proportions of the metals which are added to the magnesium.

to 3,346,106 cords of wood, which furnished 2,118,947 tons of pulp. Nearly 1½ million cords of domestic and over 670,000 cords of imported spruce were consumed. Next in order is domestic hemlock, of which 569,173 cords were converted into pulp. More than 300,000 cords of poplar were cut last year, mostly from domestic timber. The remainder of the timber, about 10 per cent, was chiefly supplied by pine, cottonwood, and balsam.

THE BULLET'S FLIGHT*

SOME NEWLY DISCOVERED ERRORS IN TARGET SHOOTING

In the face of many excuses, it is a recognized fact that the bullet from a rifle seldom strikes the target where the marksman would like to have it strike. The constant endeavor for years, in all countries, has been to perfect the rifle and reduce its errors at the target. Unlimited time and money have been expended in these efforts. According to the author of the book which lies before us, an author who speaks with a conviction gained from years of patient investigation, the innumerable causes of inaccurate rifle shooting, many of which have been known for a long time, may be divided into two great classes: first, those inherent in the rifle and its ammunition, and secondly, those which are external to it.

His experimenting and hence his discussion deals exclusively with the errors adherent to the rifle and ammunition, and does not consider any of those belonging to the second class, such as air currents, personal elements of the shooter, humidity of the air, or any error in aiming the rifle. Years of careful machine-rest shooting and the experience of thoughtful riflemen point clearly to the fact that, when all the elements of the second class are excluded, the rifle and its ammunition produce a regular and ever-present error at the target which has not yet been overcome. To determine the nature of that error is the author's primary purpose.

The cause of this ever spreading of shots he has experimentally disclosed, with the result that the rifleman knows better than he ever did before, the defects of rifle and bullets. The book teaches us how to eliminate the errors of the rifle and its ammunition, and to know which elements of the cause for such errors cannot be overcome by human skill, thus allowing us to proceed intelligently rather than under old methods of guesswork experiments.

The method and apparatus to bring out these hitherto undiscovered errors are fully set forth, illustrated, and explained. The system of investigation adopted was based on the principle of exclusion; that is, the personal element, movement of the air, mirage, and faulty aiming were eliminated. Covering as it does the work of years, the book is commendably exhaustive.

During 1901 a suitable machine rest, differing materially from anything before produced, was made as here illustrated. (Fig. 1.) It was built of concrete, and was permanently rigid. Upon it a bronze V three feet long was securely bolted. The barrel of the rifle, stripped of its normal action and wooden stock, was mounted in aluminium rings, one for the muzzle and one at breech, and, thus surrounded, was held in its normal position in the bronze V, which was accurately machined. A concentric action, as shown by illustration (Fig. 2), took the place of the normal rifle action, completing this part of the outfit. The line of fire remained the same from day to day and from year to year.

Between the rifle's muzzle and target, paper screens were placed, through which the bullet passed in its flight. A perpendicular line through the center of each screen, by the aid of telescope and cross hairs, was brought into exact line of the V rest, which was also the line of fire of the rifle barrel which lay upon it. This arrangement of

lines and screens enabled the author to follow the course of each bullet, and the screens were spaced at distances along the range to match the experiment in hand. A distance of three feet apart was sufficient for

testing some of the curves which the bullet made, but in many experiments it was found necessary to place the screens from six to three inches apart to register the bullet's motion. Day by day facts were accumulated, and at the end of several years the author could so place these screens that any desired information respecting the bullet's motions could be expeditiously obtained, one irregularity after another being eliminated to that end.

As is often found to be the case in all scientific experiments, preconceived ideas of the bullet's action proved to be more or less incorrect; and the strongest fixed idea of all,

the one to which it seemed all conclusions must be made to bend, was found to be absolutely incorrect. This idea, that the bullet during its passage through the rifle must and did fly in a straight line with the bore, and that afterward it changed its direction to fly away from the mark, held the author back from the real fact for years. Screens placed at one, two, or three feet from the muzzle showed indisputably that an unbalanced bullet left the line of fire, or line of the bore, immediately upon its exit therefrom, and the cause of this was a very astounding discovery to make.

It is easily understood that the center of gravity of an unbalanced bullet is not in its center of form, and therefore not in center of the rifle bore. Due to the twist in all modern rifles, this unbalanced bullet rotates during its passage to the muzzle and carries its center of gravity in a spiral around the straight line forming the center of the bore, and also carries its center of gravity around the center of form of the bullet itself. In mechanics, and especially in ballistics, the course through which a body moves is the line in which its center of gravity travels. Hence the unbalanced bullet (all bullets being more or less unbalanced) travels in a spiral through the straight rifled bore, compelled to take this spiral course by the solid walls formed by the internal surface of the barrel.

When the projectile is liberated at the muzzle, no longer forced to make a spiral flight, it immediately takes up a straight flight, which it must do according to the fixed laws of inertia. This straight line, however, is a continuation of the flight which the bullet was making as it left the muzzle, not the line of bore, but a tangent to the spiral which the projectile described in the bore as represented, though grossly exaggerated, by the spiral *ss* and its tangent *cc* in Fig. 3.

Fig. 3 exaggerates and makes clear how the center of gravity of an unbalanced bullet moves in a spiral form within the bore, but how, when liberated at the muzzle, it takes a straight flight, as represented by the tangent at the right extremity of the spiral in the direction of *a*. No possible power at the muzzle could make it take the direction of bore, as represented by *dd*, without disintegrating the bullet. Thus the bullet, instead of flying straight in the rifle bore, as everyone supposed, and making some change in its direction afterward, in reality flies in a spiral during its passage to the muzzle, and does not change its direction at the muzzle, because there is nothing there so to change it. This is the long-sought-for cause of error at the target.

The presence of this error, called the "X error" by the author, was clearly demonstrated in screen shooting by E. A. Leopold of Norristown, Pa., a number of years ago, and the apparent change of direction in the flight of a bullet at the muzzle was known in an indefinite manner to various riflemen. Their attempts to overcome it, and the theory upon which these attempts were

(Continued on page 210.)

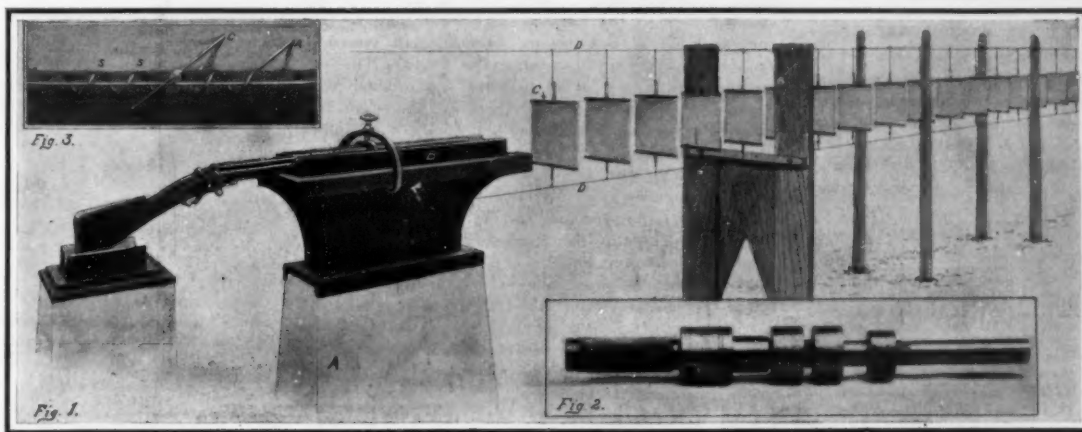
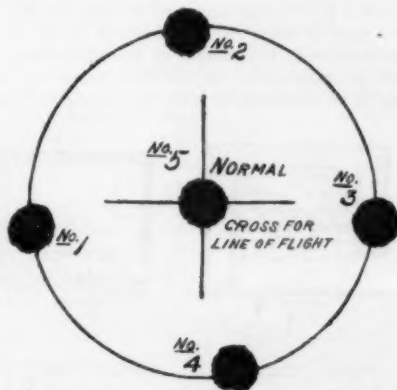


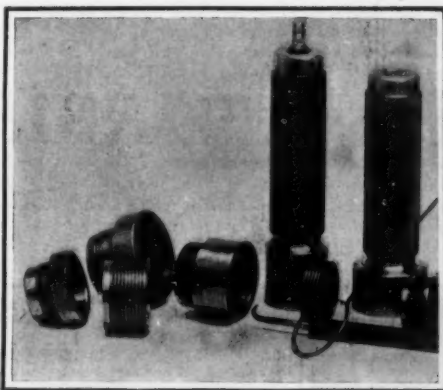
Fig. 1.—The rest and the screens. Fig. 2.—Concentric action. Fig. 3.—How the center of gravity of an unbalanced bullet moves in a spiral form and how when liberated at the muzzle, it takes a straight flight as represented by the tangent *a*.

Machine rest target shooting to detect errors in rifle and bullet.



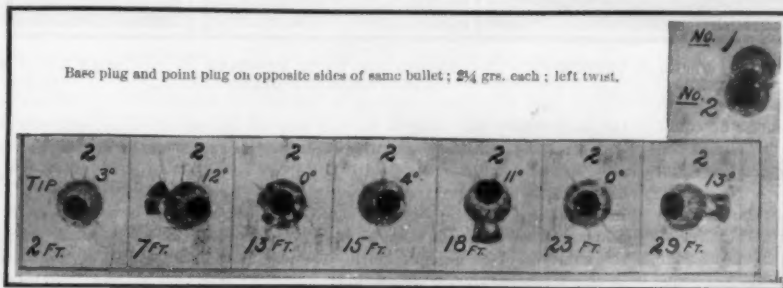
Only one bullet hit the mark (center), although all were fired under exactly the same conditions. The picture shows the X error at 12 feet from the muzzle.

Fig. 4.—Five bullets fired from a fixed rest.



This took the place of the normal rifle action, the line of fire remaining the same year in and year out.

Fig. 5.—Elements of the concentric action shown in Fig. 2.



From the cross at upper left corner where a true bullet points to numbers 1 and 2 bullet holes is $\frac{1}{4}$ inches and is the Y error at 100 yards. The seven screens at distances from the muzzle show that No. 2 shot had no X error. A like set of screens also showed that shot No. 1 had no X error. This illustration shows the error resulting from a tipping bullet.

Fig. 6.—Y-error at 100 yds. Illustrated by actual target made by two unbalanced bullets.

THE BULLET'S FLIGHT.—SOME NEWLY DISCOVERED ERRORS IN TARGET SHOOTING.

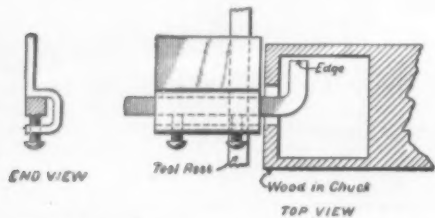
* The Bullet's Flight from Powder to Target. The internal and external ballistics of small arms. A study of rifle shooting with the personal element excluded, disclosing the cause of the error at the target. Illustrated with 188 plates, showing the results of over 300 rifle experiments performed and chronologically arranged. By F. W. Mann, B.S., M.D. Size $7\frac{1}{2} \times 9\frac{1}{2}$ inches. 384 pages. Price \$4 postpaid. New York, 1909. Mann & Co.



TOOL-HOLDING DEVICE FOR WOOD TURNING.

BY CHAUNCEY W. NIEMAN.

Those who use a wood lathe find frequent occasion to make special tools for difficult or unusual work; and when the tool is so shaped that the cutting edge is at right angles to the shank, great annoyance is experienced in holding the tool to the work, and keeping it from turning in the hand. Recently I had



TOOL-HOLDING DEVICE FOR WOOD TURNING.

a piece of work similar to that shown in the drawing, and after many expedients had failed to give complete satisfaction, I developed the device illustrated. It is made of heavy sheet steel (the heaviest I could work easily) and provided with two set-screws, as shown, to allow it to be moved along the chisel as desired, and for the insertion of new chisels. As illustrated, the flat portion lies on the tool rest, and this absolutely prevents the turning of the tool. By its use I was able to reach with ease the most inaccessible corners.

ELECTRIC INCUBATORS AND BROODERS.

BY FREDERICK E. WARD.

The advantages of an electrically-heated incubator over those making use of kerosene lamps and the like are so great, that as rapidly as cheap, reliable power service becomes extended throughout the country, the hatching of eggs by electricity bids fair to displace all other methods.

An electric incubator can be built at home by anybody who can make a wooden box and connect up ordinary incandescent lamps. Such a machine has not only the merit of being low in first cost, but of having nothing about it to wear out, and of being capable of giving perfect results with very little attention on the part of the operator.

The photographs show the first incubator built by the author, while the drawings give details of construction, drawn to scale, for a similar machine of fifty eggs capacity. Briefly, it consists of an outer and an inner wooden box, having the space between them packed with wool or other heat-retaining material. The eggs are placed in the inner box, which is warmed with incandescent lamps controlled by a thermostat.

The boxes should be made of well-seasoned lumber about $\frac{1}{2}$ inch thick. Old soap boxes furnish good material for the purpose. For a fifty-egg machine the inner box needs to be 11 inches wide, 17 inches long, and 11 inches deep, all inside measurements. This box is to be left without any top or bottom except a slatted bottom which is to be put in half way down, thus dividing the box into an upper and a lower compartment of equal depth. On top of the slats a double thickness of woolen blanket should be tacked, to support the eggs, as shown in Fig. 1.

Eight electric lamps are required for the heating units. These are best mounted in porcelain receptacles as shown, four lamps in each compartment near its top. For 110-volt circuits use ordinary 16-candle-power carbon filament lamps made for 230 volts, and connect them as shown in the diagram, where REG means regulator, or thermostat, and SS are snap switches to be placed on the outside, as shown in one of the photographs.

It is hardly worth while to make a thermostat at home when one suitable for the purpose can be bought from a dealer in electrical supplies for about seventy-five cents; but it is not a difficult job for anybody who takes pleasure in doing such work. Fig. 2 shows a simple form of thermostat attached directly to the inside of the egg chamber. The essential part consists of two strips of metal riveted together as shown in the top view at A. Zinc and steel (or iron) make the most effective combination; brass and steel (or iron) come next. The strips should be about $\frac{1}{32}$ inch thick, 8 inches long, 1 inch wide at the large end and $\frac{3}{8}$ inch at the narrow end. They may be fastened together with fifteen or twenty small rivets, or by soldering them all around the edges. The two metals thus joined tend to curl and uncurl with changes in temperature, by reason of their different rates of expansion. The large end should be clamped to a block, B, as shown, and a contact screw should be provided at C, with a stiff wire, D, attached to serve as a screwdriver for adjustment from the outside. It is highly important that the tip of the screw C and the spot on the zinc (or brass) strip be protected by pieces of platinum soldered on, or the electric arc which appears between them will soon destroy them. If the thermostat be purchased as advised, it must be mounted in such a position that the adjusting screw can be reached by a screwdriver or wire passing in from the outside through small holes in the boxes.

The inner and outer boxes are to be joined at the bottom by a passageway or tunnel three inches high, forming a doorway through which chicks may enter the brooding compartment under the egg chamber. The inner and outer boxes are to be joined near the top by three or four half-inch tubes for ventilation, as shown at V, Fig. 2.

The top of the egg chamber is best covered over with a pane of glass, on top of which is laid a small pillow or several thicknesses of folded blanket.

Next in importance to the thermostat comes the choice of a thermometer and its proper location in

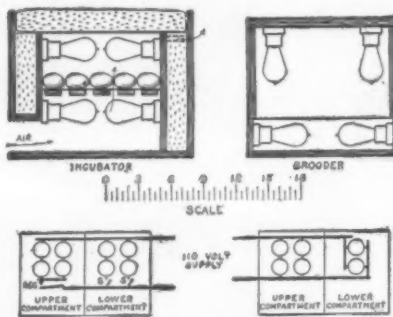


Fig. 1.—CONSTRUCTIONAL DETAILS AND WIRING DIAGRAM OF THE INCUBATOR AND BROODER.

the egg chamber, where the bulb should occupy a central position rather than one near a corner. It is not necessary to buy an expensive instrument in order to get accuracy; an ordinary ten-cent thermometer can be made to serve the purpose very well provided that its scale be properly corrected or "calibrated." This may be easily accomplished by taking advantage of the fact that the internal temperature of a normal, healthy person is just a trifle over 98 deg. Tie a thread around the tube at the place marked 98 deg. on the scale, and remove the tube from the scale, to which it is usually attached by two bits of wire. Place

eight lamps in use, the apparatus as described is capable of maintaining a temperature of 104 deg. in the egg chamber when the room temperature is only 40 deg. If used in a warmer room, one pair of the lamps in the lower compartment may be turned off by means of the snap switch.

Each pair of 230-volt 16-candle-power carbon lamps, connected in series as shown, will, when used on a 110-volt circuit, burn with a dull red glow scarcely visible in daylight, and with a power consumption of $5\frac{1}{2}$ watts. A fifty-egg machine operated in a room where the temperature is 65 deg. consumes about 16 watts, making a total for 22 days of about 8 kilowatt hours, which, where the rate is 10 cents, costs 80 cents. This cost looks high at first sight, but it is materially lower than that of a kerosene-burning machine if one stops to consider the saving in interest on first investment,

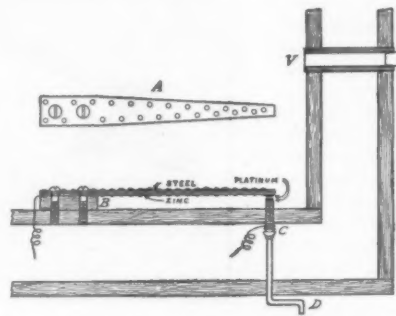


Fig. 2.—METHOD OF APPLYING THE THERMOSTAT.

the saving in oil, the absence of depreciation and repair bills, and the saving in labor of attendance.

In the practical operation of the incubator, the following points should be borne in mind:

The eggs need to be turned partly over every day. A good way to do this is to take out the row of five eggs at the left-hand end, roll the remaining ones toward the left, and replace the five at the right-hand end. This progressive movement serves also to even up the different times of hatching that might result from some eggs remaining in warmer spots than others.

Increasing ventilation is required as incubation progresses. Practically no air is needed the first two weeks, and all ventilating tubes and the door to the lower compartment may be kept closed with considerable economy in power. During the third week, and especially when the hatch is due, plenty of air must be allowed to filter up through the eggs, as shown by the arrows in Fig. 1.

No moisture is required during the first week. Thereafter it is best to keep a small pan of water in the lower compartment and a small glassful in the egg chamber. These serve to prevent excessive evaporation of the eggs by too dry air.

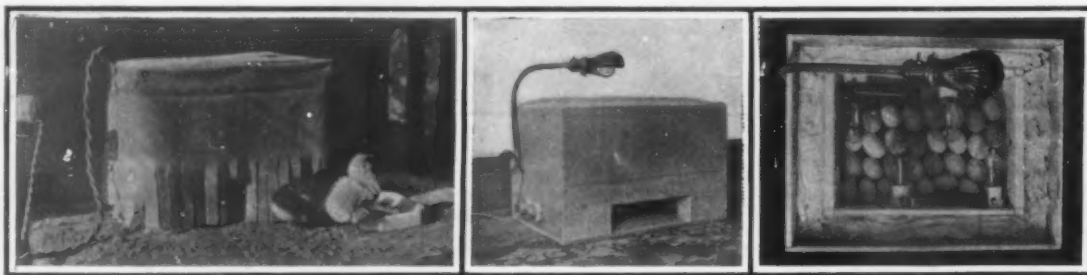
The newly hatched chicks should not be taken out or fed until they are 24 hours old. After this they may be kept in the lower compartment for a time, provided all four lamps be kept burning. As soon as convenient, however, they should be transferred to an electric brooder, two forms of which will now be described.

The first and simpler form, suitable for use only in a well warmed room, is shown in one of the photographs. It consists of a small wooden table carrying on its under side four lamps, and surrounded by a fringe made by slitting a piece of old blanket. For use on the ground or where the floor is not warm, bottom heat must be provided as shown in Fig. 1. Forty

chicks can be accommodated by such a brooder having the following dimensions: Top, 14 by 20 inches, supported by legs 8 inches long. Bottom box of wood, 14 by 20 inches outside, 3 inches deep inside. Box-cover of tin 14 by 20 inches, protected on top by a sheet of paper and a

sprinkling of sand. Four lamps are required in the upper part, one near each corner, and two in the bottom heater. It will be observed in the diagram of connections that the latter lamps are connected in parallel and not in series, which causes them to burn more brightly. The power consumption is 33 watts, or about twice what is required for hatching. No thermostat or thermometer is needed for the brooder. It will not get too warm if the current is left on all the time.

Where any form of bottom heater, such as that just described, is used it is necessary to either sink it level with the floor or to provide sloping boards by means



THE BROODER WITHOUT BOTTOM HEATER.

INCUBATOR WITH BROODING COMPARTMENT OPEN.

PLAN VIEW WITH COVER REMOVED.

the bulb under the tongue at the side of the mouth and hold it until the mercury column does not rise any higher. By observing with a mirror it will then be possible to determine quite accurately how much in error the marking on the scale may be, and due allowance for this can then be made by assuming that the same error is present at the 104-deg. mark, which is the temperature of incubation.

The machine must be run a few days before any eggs are put in, to give time for carefully adjusting the thermostat. When the latter is once set right it will automatically maintain the heat at the desired point by "winking" the lamps on and off. With all

of which the chicks may get up on the raised platform. The following bill gives a list of all materials needed and their present retail prices:

For the Incubator.

8 230-volt 16-candle-power carbon lamps	\$1.60
8 porcelain receptacles	.48
1 thermostat	.75
1 thermometer	.10
2 single-pole snap switches	.30
1 piece 12 x 18 window glass	.20
Lumber, etc.	.15

Total \$3.58

For the Brooder.

6 230-volt 16-candle-power carbon lamps	\$1.20
6 porcelain receptacles	.36
1 sheet 14 x 20 tin	.15
Lumber, etc.	.05

Total \$1.76

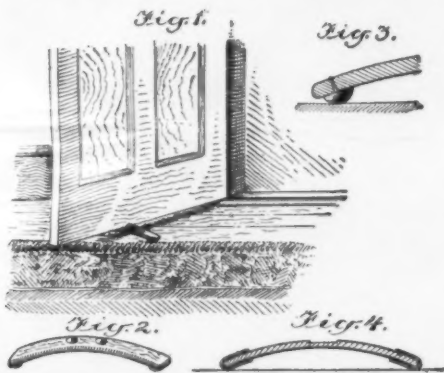
The foregoing bill does not include the shaded lamp and fixtures shown on the outside of the incubator in Figs. 1 and 2. An ordinary 4-candle-power lamp so mounted is a convenience, but not in any way essential.

CONVENIENT DOOR HOLDER.

BY D. PENNINGTON.

A convenient door holder may be made from a barrel hoop, as shown in the accompanying illustrations, by cutting a piece about eight inches long and inserting a rubber-head tack (such as used in the plumbing trade) at each end, on the under side, as shown in Fig. 3. Two such tacks are also placed on upper face, spaced apart sufficiently to allow the bottom of the door to fit between them. The arched shape of the hoop will give sufficient friction between the door and floor to hold the door in any desired position.

If rubber-head tacks are not available, the ends may be covered with some soft material such as carpet and tacked thereto. In place of tacks, a notch may be cut in the barrel hoop equal to the thickness of the door, as shown in Fig. 4 of the illustration. The



HOME-MADE DOOR-SECURING DEVICE.

center of a barrel stave may be used instead of a hoop by cutting it to about the same width as the hoop.

BORING HOLES IN GLASS.

BY GEORGE J. MURDOCK.

Glass is universally conceded to be exceedingly difficult to work when cold, yet its fragile nature often calls for means of repair. It is also desirable sometimes to drill large holes in glass plate, or through a glass column, which is not an easy thing to do with any facilities hitherto developed for such work.

It is well known that turpentine applied to a small drill will enable one to drill through a piece of glass by persistent application and frequent grindings of the drill. This hole will often taper from a larger diameter at the top to a smaller one at the bottom, and besides it is quite impossible to drill two holes of the same size with the same drill. Instrument work of certain classes would be made better also if it were possible to tap threads in the glass of which the base or other parts are composed. In the opinion of the writer the best fluid to be applied to the glass so that the tool will take hold is that of the formula given below. It has been developed after many experiments with different mixtures, and will be found to be superior to anything heretofore known. With a bastard file wet with it, a piece of plate glass may be put into a vise and filed like wood; any other cut of file may be used, but where there is much glass to remove, the coarser the file the better.

For drilling small holes, a brass tube of the diameter of the hole wanted is better than a drill. The tube should be made smooth on the end that is to come in contact with the glass, and charged with carborundum powder, or what is better, diamond dust. In starting the hole a piece of wood having a hole drilled in it of the size of the brass tube should be cemented to the glass, the hole being located over the spot where the desired hole is to be made. A hole should be

made in the side of the tube by filing into it with a round file, and it may be turned either by a drill press or by one of the small, geared, hand drill-stocks used for small drills. With a small brush dipped into the solution as herein given wipe the hole so that a little of the mixture will run down inside the tube, and onto the glass where the hole is being made, and the tube will be found to enter the glass with surprising ease.

If it is desired to have the edge of the hole sharp where the tube comes through, cement a small piece of

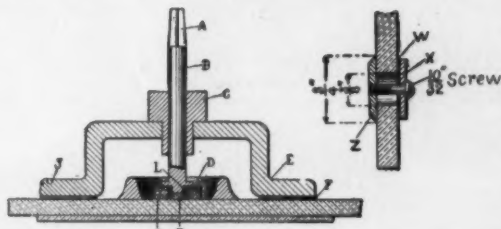


Fig. 1.—APPARATUS FOR BORING LARGE HOLES IN GLASS. Fig. 2.—METHOD OF REPAIRING CRACKED PLATE GLASS.

glass to the under side of the plate being bored, and when the tube is through, continue the boring until it has entered the lower plate slightly. Glass cut with the diamond will often break unevenly, and fail to fit a window sash; circles cut out for the dials of instruments of the clock class, circles for static electric machines, glass covers for galvanometers, ammeters, and many other instruments are often thrown away, when a touch with a file wet with this solution would save them. It is especially recommended to glaziers to remove the sharp edges of the glass cut with the diamond, which often cut the hands. For boring large holes in plate glass the jig shown in the sectional view, Fig. 1, is very handy, in fact almost essential if correct results are required. It can be easily modified to hold the cutter for boring circular work, such as glass columns or concave surfaces, where circumstances require such variation. The frame is an iron casting having feet *J*, and is bored out to receive a steel bushing *C*, which may be hardened after a central hole is made to receive the shank *B* of the cutter bar. The top of the cutter bar or shaft is squared at *A* so that a bit stock may hold it, or it may be held by the chuck of a drill press. The bottom has a flange and a pilot *L*, which fits in the hole of a small emery wheel *G* of the kind used by toolmakers on universal grinding machines for lapping out small holes.

The lead bushing in the wheel should be cut out on the side that is to do the boring, and the pilot *L* must not go entirely through the wheel, but be cut at least $\frac{1}{4}$ of an inch short of the wheel thickness. The wheel may now be cemented to the cutter shaft by heating it, and also the wheel slightly, so as to melt some gum shellac which has been sprinkled on the top side of the wheel. After it is cold mix up a stiff paste of liquid glue and emery of about the same grade as the wheel, and fill the bottom of the hole *P* even with the wheel. In drying it will shrink slightly, and the paste may be applied again, and until the surface is flush with the side of the wheel.

The feet *J* of the frame have thin rubber *F* (known in the stores as "rubber dam") cemented to their under sides with bicycle tire cement, so that when placed on the glass the jig will not slip around, but can be easily held in any desired location.

The place where the hole is to be made having been ascertained, a ring of putty *D* is stuck to the glass to form a cup; and after the wheel shaft is inserted in the bushing, the apparatus is placed with the face of the wheel over the spot to be bored, with the feet *J* resting on the glass. Before beginning operations a piece of double-thick window glass *H* is cemented with French copal varnish to the under side of the plate to be bored.

The formula for the fluid to be applied to the tools is as follows:

Pulverized camphor oz. ii.
Sulphuric ether dr. vi.
Enough oil turpentine to make a six-ounce bottle full.
Apply the bit stock to the shank *A* of the shaft, then pour enough of the fluid into the putty cup to cover the lower side of the wheel *G*.

When the wheel is turned it will immediately enter the glass, boring a very smooth and true hole. If a drill press is used, the speed should be slow to avoid throwing the fluid out of the cup or heating the wheel, the last being especially avoided, as all of the constituents of the fluid are very volatile, and it will evaporate quickly if much heat is present.

When the hole is nearly through moderate the pressure, but keep on drilling until the wheel has entered the plate *H* slightly. A slight tap with a hammer will now knock the window glass off, and the wheel and shaft may be removed through the hole. Do not attempt to remove it through the top unless the hole is very clean, or you will pull the wheel off the arbor.

Fig. 2 shows how a cracked plate-glass window may be repaired. At the ends of each crack and where they intersect, a hole is bored to receive a bolt. The nut *Z* of the bolt is made thin, and a rubber washer, made of engine packing, is held against the glass by a washer and screw. The dimensions given are those used some time ago in repairing a store window. The heads of the screws were located inside the store, so as to make it impossible to remove them from the outside. The window is still doing service.

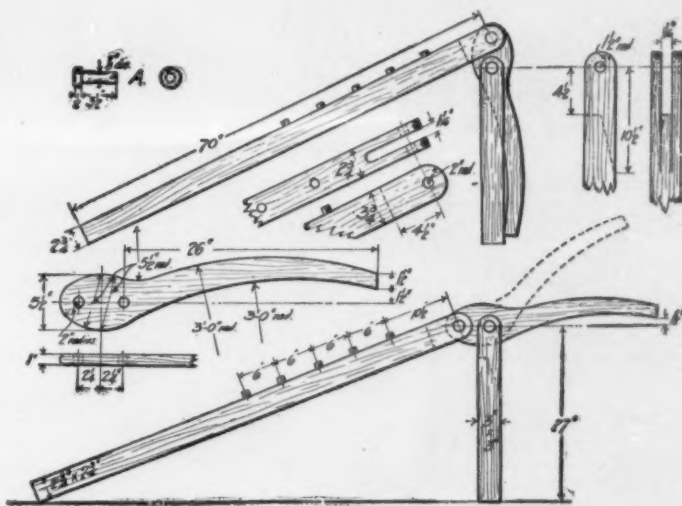
A WAGON JACK.

BY L. G. BAYLEY.

For oiling wagon wheels, or taking them off, some kind of lifting arrangement is resorted to. For simplicity of construction and effectiveness the jack herewith described is unique. The whole, including the pegs or pins *A*, is made of oak, the best tough white oak being recommended.

The beam is made from 3- by 4-inch timber, planed down to the dimensions given. An eye or slot is cut out at the wide end, $1\frac{1}{16}$ inches wide by $4\frac{1}{2}$ inches deep. This end is rounded off to a radius of 2 inches. Five pegs, 1 inch diameter by 2 inches in length, are driven into the upper side. The holes are 1 inch deep and should allow the pegs to have a driving fit.

The upright is 27 inches high to the center of the



A WAGON JACK.

fulcrum, made from 3- by 3-inch stuff. The end is rounded off to a radius of $1\frac{1}{2}$ inches, and a slotted hole is cut in, as indicated in the detail view.

The lever is cut from 1-inch board, 6 inches wide by about 33 or 34 inches in length. It should be laid out accurately to the dimensions given in the larger scale view. When correctly made, and the slot in the upright cut likewise, the two holes for the pegs *A* will be in a vertical line, when the lever is pressed down, as shown in the upper general view. The pegs *A* should have a loose fit, and be furnished with small wooden pegs or nails, to keep them in place, when the parts are assembled.

To operate the jack, the lever is raised, as shown in dotted lines in the lower general sketch, and the beam slipped in place under the axle of the wagon, which should rest between one of the small pegs in the upper face. Bearing on the lever, it is pressed down into its lowest position, as shown in the upper sketch, raising the wagon wheel from the ground and securing it in that position indefinitely, without the least chance of its slipping back.

Swelling ground cannot be held by timber; means must be provided for relieving the pressure of the ground from time to time. It will cause little trouble if spaces are left between the lagging, through which the pressure may be eased at intervals by removing some of the material. Expedients such as packing with straw are valuable only until the swelling becomes sufficient to pack tightly the cushioning substance. When this becomes packed solidly it transmits the pressure to the timbers.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

TIE-CLASP.—A. M. BANTA, New York, N. Y. In this case the invention relates to tie clasps such as are attached to four-in-hand ties to secure them to the shirt front. The object of the improvement is to produce a tie-clasp which can be very simply constructed, readily applied, and effective in holding the tie in position.

Electrical Devices.

SYSTEM OF INSULATION.—L. STEINBERGER, New York, N. Y. Mr. Steinberger's invention relates to systems of insulation for high potential electric conductors to be used in various relations and for various purposes, such as power transmission; and for guy wires or cables employed as stays, towers, or for poles, masts, and other supports used in wireless telegraphy, as well as in ordinary commercial work.

CIGAR-MOISTENER.—I. C. TETHEROW, St. Joseph, Mo. In the present patent the invention has for its object the provision of a device to be used in show cases (where the lamp or coil used is connected with a source of electric current), which will vaporize a sufficient quantity of water to keep the atmosphere of the case moist so as to prevent the drying out of cigars placed therein.

Of Interest to Farmers.

PLOW.—J. G. REDMOND, Fairmount, Ill. The intention here is to provide means for lifting the plow cylinder from the ground, as when taking the machine to and from the field, this means being preferably constituted by crank arms attached at opposite ends of the plow axle, each having a wheel journaled at its outer end, with one of the arms provided with an operating lever, and means for positively driving the wheels from the plow.

FRAME FOR MANURE-SPREADERS.—E. SCHALL, New Staplehurst, Neb. The frame is adapted to be attached to a wagon or cart body so as to adapt the same to be used as a manure spreader. The object of the invention is to produce a frame which can be readily attached to the box or body of the cart or wagon, and which will be constructed in such a way as to facilitate the removal of the manure from the rear end.

DEVICE FOR DISPENSING TRAVELERS.—J. S. DRAKE, Lancaster, S. C. In spinning cotton the travelers, after a few days' use, wear out and are replaced. A great amount of time is lost in endeavoring to loosen a single traveler from the entangled mass and the result is a loss to the mill, as about four travelers are purchased for one actually used. This invention provides a dispenser which delivers one traveler at a time, which avoids unnecessary waste, and saves considerable time.

Of General Interest.

CIGAR-BUTT FORMER.—J. CARTER, New York, N. Y. The aim in this case is to provide certain improvements in the formation of the butt end of cigars, whereby convenient and accurate folding and fixing of the wrapper to the butt end of a cigar is obtained, without resort to the expensive manual operation of cutting, shaping and pasting.

DOOR LOCK AND SWITCH.—E. E. SAPHIRE, New York, N. Y. The purpose here is to provide for elevators a door lock and switch, arranged to prevent the shaft door from being opened at the time the car is not at the landing, and to prevent the car from being moved away from the landing, either in its ascent or descent, until the door is again locked.

DISPLAY STAND.—H. ROSENTHAL, Yonkers, N. Y. This stand is intended for use in displaying confectionery, cigars and the like. One object is to provide a transparent protective closure which may be readily applied to a box containing confectionery, cigars and similar articles of merchandise, in order to protect the same from moisture, dirt, etc.

INSECT-CATCHER.—A. H. LEE, Canby, Ore. In this construction the inventor employs a fruit partially decayed, as a bait, and utilizes the container of poisonous or destroying liquid as the cover or top for the fruit container. In connection with these containers he preferably employs a light suspended with its lower portion adjacent the surface of the liquid, so as to attract the insects at night.

DESK ATTACHMENT.—J. A. SMYLIE and G. D. McELWEE, Centerville, Miss. This device will facilitate the handling of books in office work, and consists of a carriage, wherein novel features of adjusting and controlling the travel of the same are made use of, permitting the carriages to travel in any inclined plane without the use of a track or guide.

MAGAZINE-BINDER.—J. POMORALEK, New York, N. Y. This binder is of book form, having a number of leaf-retaining bars at the back, extending longitudinally and provided with cross-pins, each bar engaging a pin by an endwise movement on the other pin by a lateral movement, and casings extending over the opposite end portions of the pins, with the casing of the pin engaged by a lateral movement of the bars movably mounted to pass into and out of overlapping relation to the latter, whereby the bars are locked and unlocked.

ROAD-GRADER.—J. P. LUTER, Buffalo, Mo. The invention is an improvement in road

graders or drags, and has in view a device of this character in which each scraper takes care of its own dirt from the time it leaves the ditch until it is discharged at the center of the grade, thus avoiding the danger of clogging, and making the device easy of operation and light of draft.

Hardware and Tools.

RIVETING DEVICE.—J. TISCHLER, East Portchester, Conn. The invention pertains to certain improvements in riveting devices and involves a clamp so constructed that it may engage with the head of a rivet to hold the latter in place, and at the same time, to leave the opposite end of the rivet exposed so that it may be pounded or beaten into the form of a second head.

UNDERCUTTER-SUPPORT.—W. J. WHITWORTH, North Bend, Ore. This invention refers to supports for saws, and particularly to the means of adjusting the supporting-arm, and to the means of adjusting the holding-dog. Means provide for adjusting the supporting-arm relative to the holding-dog; and for adjusting the holding-dog relatively to the other parts.

RAKE FOR ROTARY LAWN-CLEANERS.—C. H. MOSHER, Salisbury Mills, N. Y. The invention relates to cleaners such as the one formerly patented to Mr. Mosher. The object is to produce a rake in which the teeth are separately attached, and in which the teeth are arranged in rows or phalanxes, the individuals of each row being advanced progressively with respect to each other.

SEAL-LOCK FOR RECEPTACLES.—C. H. JOHNSON, Petaluma, Cal. The invention refers to attachments for signature seals for safety boxes and the like; it also has reference to safety boxes in which a number of persons have separate keys for separate locking openings in the same box, and in which a plurality of signature seals are used to cover the locking openings.

DOOR-LOCK.—L. F. ROBERTS, Howard, Kan. The object here is to provide a lock of the combination type. It embodies details that adapt the lock for service as a door latch, that may be freely operated by means of a knob on the inner side of the door, but which will require manipulation of latch controlling disks, set to a certain combination for release of the latch bolt from the exterior of the door.

NUT-LOCK.—C. E. DAVIDSON and B. I. MAULDIN, Odessa, Texas. The invention is an improvement in nut locks and has for an object to provide a construction affording a pawl-like device carried in the body of the nut and adapted to bed itself in the bolt threads or seat in grooves or channels formed therein.

RATCHET WRENCH.—W. COOK, Phillipsburg, N. J. This wrench has a ratchet wheel presenting a socket which may be applied to the head of a nut or bolt for rotating the same. This wheel is mounted in a ratchet head and is adapted to be advanced by means of a lever operating through a pawl. The socket is constructed in such a way as to enable it to retain inset jaws which reduce the size of the socket or enable it to be used as a pipe wrench.

Heating and Lighting.

INVERTED INCANDESCENT GAS-LAMP.—G. RAAP, 36a Blumenstrasse, Berlin, Germany. This invention has for its object an incandescent gas burner, in which, by making the metal walls of the burner head and of the mixing tube of appropriate thickness, and if desired in combination with means for conducting away the heat, a regulation of the heating effect is obtained.

Household Utilities.

AUXILIARY WATER-CLOSET SEAT.—J. G. STEFFEE, New York, N. Y. This invention provides an auxiliary seat for the use of small children in connection with the regular seat of a water-closet, privy, hospital commode or other night-soil receptacle, the auxiliary seat being so designed that it affords the maximum convenience and comfort and so that it can be placed upon the regular seat board used by adults and firmly maintained in position.

CURTAIN-POLE BRACKET.—B. LUTICH, New York, N. Y. In the present patent the invention has reference to brackets, such as used for supporting curtain-poles. The object of the inventor is to produce a bracket of simple construction which can be readily attached to a window casement and which will afford support for a curtain-pole.

MATCH-RECEPTACLE.—H. WARK, New York, N. Y. The object in this instance is to provide a match-receptacle to be employed with safety matches or with ordinary matches, from which the matches can be taken one at a time without difficulty, which can be easily and expeditiously filled with matches, and which is neat and attractive in appearance.

SHUTTER AND VENTILATOR.—W. P. RYLANDER, San Marcos, Texas. In this instance the invention pertains to improvements in shutters of the slatted type and has for its object to provide a shutter which may be used for ventilation alone, for ventilation and at the same time securing privacy, and finally to produce a shutter which may be so adjusted as to be practically a solid blind.

TEA AND COFFEE SAVER.—E. F. CORBETT, New York, N. Y. The more particular purpose in this patent is to provide a cage

movably mounted within a pot and adapted to be raised and lowered in order to expose the tea or coffee to the liquid. Means provide for holding the cage in a plurality of different positions, so that the cage and its contents may be in one instance completely submerged and in another completely raised out of the liquid.

Machines and Mechanical Devices.

LIFTING-JACK.—G. R. BOOTH, Chana, Ill. The improvement has reference to lifting-jacks, and has for its object to provide one with all the parts so proportioned and disposed that it is compact, strong, while of light construction, easy to operate and the parts of which, when at rest, will rattle very little, if at all.

VENDING-MACHINE.—W. ASBURY, New York, N. Y. An object here is to provide a machine with mechanism by the means of which a practical two-coln machine is produced. Another object is to provide means by which a coin will bring a lever into operative position to be actuated by an arm secured to a shaft by the means of which the ejecting mechanism may be actuated.

APPARATUS FOR THE PURIFICATION OF WATER.—J. P. LAJOIE, Taverny, Avenue Delarivière, Seine, France. The invention relates to mechanism for purifying water used for various purposes, and especially for manufacturing, the more particular purpose being to rid water of calcareous matter and various salts which might otherwise coat the interior of boilers. A few moments of each week of an operator's time is sufficient to keep the apparatus in constant operation.

MULTIPLE SELF-INKING STAMP HOLDER.—V. W. BOLLER, Fort Thomas, Ky. More particularly the invention relates to improvements whereby any one of a series of stamps carried by the holder may be brought into operative position in respect to the inking device, and, at the same time, be in proper position for application to the surface to be stamped.

SHAPER ATTACHMENT.—L. KRAMER and C. BROWN, Evansville, Ind. By means of the attachment material may be turned into various shapes by adjustment of different forms to the machine, the forms being secured to the shaft in which the material is secured for rotation, and the forms acting on the knives to produce the desired result. Means permit the gradual movement of the material to be treated, against the knives and to hold it yieldingly in this direction.

PAPER-FOLDING MACHINE.—A. B. COLLOM, L. E. MCCLINTOCK, W. C. STEWART and R. R. MCNEIGHT, Marietta, Ill. The machine is particularly designed to prepare, by folding, or doubling, the tie sack and pouch labels used by postal and post office clerks. The machine will fold the slips and print the name and date thereon, and deliver the folded labels in order to a receiving box. A novel feeding mechanism is also provided for automatic action.

UNIVERSAL CONTROLLING-VALVE.—W. C. ARP, F. F. HILBRETH and F. N. RUMBLEY, Terre Haute, Ind. This invention relates to valves for controlling the operations of mechanism which are actuated by compressed air, steam or vapors under pressure. An object is to provide a device in which, by the simple manipulation of an operating handle, the control of the various pipes and cylinders in an air-brake system is effective.

STENCIL-MACHINE.—R. C. WIGHT, Richmond, Va. This invention is more particularly designed for use in places where a number of packages or articles have to be impressed with the same name and address, although it may be conveniently used when only one name and address is to be impressed. The main object is to provide a device in which a name can be quickly set up and then impressed upon the article at one operation.

BELT-RACK.—R. L. SMITH, Lincoln, Neb. The rack occupies little room and carries many belts which may be readily moved to the desired position to permit of their being unrolled. Another object is to so construct the device that the belting will be prevented from slipping from the spindles by the frame of the device, it being possible to move the spindles to a position at which the belts can be readily moved.

MIXING-MACHINE FOR FERTILIZERS OR CEMENTS.—C. R. HERRICK, Atlanta, Ga. The machine comprises a crusher which is employed in connection with one of the hoppers, which enables one of the ingredients to be crushed as the mixing takes place. The construction involves a tumbling barrel, which receives the ingredients to be mixed, and this barrel is rotated continuously in an inclined position so as to bring about a thorough mixture of the different ingredients.

BRAKE FOR ELEVATORS.—W. R. ELLIOTT, Somerset, Ky. Means are here provided whereby the action of the car can be controlled in the ordinary operation; means whereby the car may be automatically arrested in the event of its starting to fall; means whereby a car may be held immovably in any arrested position; and to simplify the construction and arrangement of the parts constituting the brake, and to decrease the cost of the device.

BELT-FASTENER.—C. O. L. CARDELL, Pearl River, N. Y. The object here is to provide a fastener for securely connecting the ends of the belt with each other, so that the belt is exceedingly flexible at the joint, is not liable

to fray or ravel at the junction or at the sides of the joint, and the belt is guided to run centrally on the crowns of the belt pulleys over which the belt passes.

CIGAR-CUTTING MATCH-RECEPTACLE.—J. P. CROSTHWAITE, Sadleville, Ky. In this device the matches are delivered successively and in a lighted condition; it delivers a match and simultaneously cuts the end of a cigar; it stores the matches in a receptacle to be delivered therefrom successively; and it maintains the lock in the receptacle in operative position until the matches are completely or nearly exhausted.

AUTOMATIC REGULATING DEVICE FOR WATER-TANKS.—W. L. BRUBAKER, Harrisburg, Pa. The device is particularly applicable for keeping filled the tanks or troughs disposed in the center of a railway track for the purpose of supplying water to a passing engine. The device is actuated by a float in which the valve mechanism is operated directly by the water pressure from the water main.

Prime Movers and Their Accessories.

GOVERNOR.—J. P. NICKONOW, Evansville, Ind. Particularly stated, this invention relates to improving the valve mechanism forming a part of the turbine and also improving the form of the weights operated by centrifugal force, and also improving the form of parts associated with these weights and with the valve controllable by the governor.

Railways and Their Accessories.

FLUE-POINT AND ITS ATTACHMENT TO FLUE-SHEETS.—C. S. COLEMAN, Spokane, Wash. Mr. Coleman has demonstrated by numerous experiments, that, by providing the flue-point with a recessed shoulder, and by employing a gasket of soft metal, the same being provided with a head interposed between the flue-sheet and the shoulder of the flue-point, and by expanding and bending the outer ends of the flue-point, he is able to form a tight joint which practically avoids leakage.

Pertaining to Recreation.

GAME APPARATUS.—W. F. SCHNELLE, Cincinnati, Ohio. In this patent the invention relates to games to be played, and it has for its object the provision of a board and moving pieces, which may be constructed at little expense, and which may be used to play an interesting and novel game. The game comprises a base ball field, bases, runners, scoring of points, the playing of innings, and other features of base ball.

SOUNDING TOY.—A. H. F. SCHLIECKER, Vinita, Okla. The toy is adapted to produce snapping sounds of various tones and qualities. The object of the invention is to produce a device which may be cheaply manufactured, and which is adapted to produce sounds of various pitches by varying the manner of manipulating the same.

AMUSEMENT DEVICE.—R. FARRELL, Tappan, British Columbia, Canada. Among the principal objects which the present invention has in view are: To provide an apparatus whereby is produced the illusion of floating in mid-air; and to produce a simplified construction for an apparatus designed to produce the above-mentioned desired effect.

Pertaining to Vehicles.

BICYCLE AND MOTOR-CYCLE HOLDER.—W. A. SETTLE, Wallace, Idaho. The device is permanently carried on the frame of the cycle, and can be adjusted to hold the cycle in an upright position when not being ridden, the support being adjustable to engage one of the pedals of the cycle so that the latter will be firmly held against movement should the cycle be in a standing position on a grade.

LOCKING DEVICE.—F. D. WINTERLING, New York, N. Y. The invention relates to manually controlled levers, such as the controlling levers of automobiles and the like, and its object is to provide a device arranged to securely hold the controlling lever in position against accidental displacement, and to prevent the operator from shifting the controlling lever too far.

Designs.

DESIGN FOR A COVERED DISH OR SIMILAR ARTICLE.—C. ZIEGLER, Limoges, France. The design presented is an interesting and ornamental covered oblong dish, with a sloping top and base and end handles. The design includes the representation of neat yet fanciful scroll work, forming a pleasing ornamentation.

DESIGN FOR A GLASS GOBLET OR SIMILAR ARTICLE.—C. O. NORTHWOOD, White Mills, Pa. The ornamental design in this case represents a glass goblet of exquisite body curves, a slightly tapering narrow column connecting it with a flat base. The ornamental features cut in the goblet are very artistic. Mr. Northwood has designed another glass goblet of the same general curves and shape, but with flower ornamentation very dissimilar; and also a third glass goblet with a somewhat decided departure from the other two, and with a broader flower ornamental display in the body.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE HISTORY OF FRENCH LITERATURE FROM THE OATH OF STRASBOURG TO CHANTIER. By Annie Lemp Konta. New York and London: D. Appleton & Co., 1910. 8vo.; 850 pp. Price, \$2.50.

As a general rule, an author divides the prospective readers of his work into two categories, and a book is usually designed with these divisions in view; it is intended for the perusal either of the student, or of the general, casual reader, and seldom answers the purposes of both. Mrs. Konta, however, has furnished us with an exception to this generalization. In her excellent history of French literature, and it can truthfully be said that both the student and the lay reader will find much of interest and of high literary value in her book. The work is a concise, and clear chronology of practically the whole of French literature, beginning with the formative period. The history is technically most thorough and systematic, and that it is the result of long-continued, conscientious study and investigation becomes apparent to even the most cursory reader. It is naturally difficult to treat a subject of such comprehensive nature, so that its necessary brevity does no violence to the mass of information which must be included, but the author appears to have solved this problem successfully. The appended bibliography is excellent. Another good feature is found in the thorough index, an element so necessary in a book of this kind, and so seldom properly done. Aside from any pedagogical value, the book is of great interest, owing to the many interesting and amusing anecdotes and stories, which the author has compiled from different sources, regarding most of the prominent figures of French literature. Many of the anecdotes have been discovered in obscure French sources, and appear for the first time in English in Mrs. Konta's book.

THE HISTORY OF ASTRONOMY. By George Forbes, M. A., F.R.S., M.I.C.E. New York and London: G. P. Putnam's Sons, 1909. 16mo.; 200 pp.

Prof. Forbes has written a very instructive little book on the history of astronomy, which he divides into four periods—the geometrical, dynamical, observational, and the physical. Thus he traces the evolution of intelligent thought in the progress of astronomical discovery, and by recognizing the different points of view of the different ages gives credit even to the ancients. Although the history has been necessarily curtailed, still it lays before the reader in a limited space just enough about each age to illustrate its tone and spirit; to give some conception of the ideals of the works; to present logically and gradually different and new points of view and additional means of investigation.

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For which Letters Patent of the United States were Issued

for the Week Ending

February 22, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Advertising device, N. Stipkowitz	950,300
Advertising device, motion, A. H. Douglas	950,190
Aerial machine, J. Beard	950,427
Air brakes and economizing air, means for releasing, W. S. De Camp	950,105
Air cylinder, W. L. Abate	949,872
Air level inlet for house or other drainage, fresh, B. Knox	950,332
Air, separation of oxygen and nitrogen from liquid, G. Claude	950,430
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Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 23rd or will be sent by mail on request.

(12203) B. S. writes: I here add my experience with treating old dry batteries with hydrochloric acid, as it once said in your paper, and this is my view of the matter. If a person is in a place where batteries are hard to get, or if he only cares for a set of batteries that will finish the season, etc., or if he thinks the time that he spends on fixing the old batteries is cheaper than a new set, fixing the old batteries is all right. I am in a place where batteries are hard to get and are high. I have lots of time to spend on such jobs, the acid cost me fifty cents. I don't count my time. I find the batteries will do about a third or half of the work a new set will do. A. We think this is reliable.

(12204) F. McC. asks: Does a train while running on an absolutely level track and at a very high rate of speed have any less pressure on the rails than when at rest? We have it figured out by a learned professor that a train running around the entire surface of the earth at the rate of 4.91 miles per hour would have no pressure on the rails, but we think that he has taken into consideration the circular shape of the earth's surface, and figures that the centrifugal force would throw it away from the center and cause it to have no pressure on the rails at the speed. What we want to know is that if it were possible to build a track of equal length, absolutely level, regardless of the earth's surface, as level as the lines of a ray of light, would a train running at a high speed have any less pressure on the rails than when at rest? If it does have less pressure, what law causes it to have less pressure? What force causes it to rise? A. There is no reason whatever why a train running at any rate of speed should reduce its pressure upon the rails if the earth's surface is considered as a plane and centrifugal force is neglected while gravity remains constant, unless, of course, it is equipped with aeroplanes at such an angle of attack as to use wind pressure to decrease its rail pressure. It is easy to calculate the speed at which centrifugal force will theoretically balance the attraction of gravity, but it is demonstrably untrue that there is any such effect in practice, for a combination of reasons too long to be discussed here. It may be shown that the driving wheels of a locomotive press less on the rail for a part of their revolution at high speeds, and even leave it altogether, but this is entirely due to inadequate balance of the thrust of the reciprocating parts at such speed, and has no connection with the principle of your problem. It is imaginable also that a train might ascend a gradient on a trestle, for instance, at such a speed as to leap off at the end and be carried some distance by the ballistic effect of its momentum, from which it might be argued that reduction of rail pressure by speed is analogous, but this again is outside the limits laid down in your question.

(12205) H. L. F. asks: I would like to know if a head of three or four feet of water, with an abundant supply of the same, can be used in a turbine with anything like a fair efficiency in operation. Can you give me an idea of what one could expect to achieve in the efficiency of a turbine so placed? A. There is no reason whatever why an unlimited supply of water, with only four feet of head should not generate a large amount of power with economy and efficiency, provided a suitable turbine especially designed for low head is used, and there are many good ones. The theoretical horse-power developed would be 0.09756 Q, in which Q is the quantity of water in cubic feet per minute available, of which at least 75 per cent should be obtainable in actual useful work with a suitable turbine.

A kindly critic who has been a professor of mathematics for many years has objected to the answer to an inquiry regarding the equation of time, which we printed few weeks since, that it is not sufficiently exact. From the point of view of a mathematician or the astronomer the criticism has some reason. The degree of inexactness of our answer may be seen from the fact that the difference from day to day for the years 1909 and 1910 is not as much as 9 seconds at any time, excepting for a few days near the end of December, and is less than 5 seconds except for a short time near the autumnal equinox. Anyone needing the equation of time exactly must go to the Astronomical Ephemeris for it, where it is given for each day of the year at Greenwich apparent noon, with the difference for one hour, from this time for any other longitude can be calculated. For all common uses, such as setting a clock for local time by the noon mark, or the rising of the sun, as we used to do when we were a farmer boy in the country, the equation of time as given in an almanac is all that is necessary.

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(Concluded from page 203.)

boat, two men expect to make the hazardous 7-mile trip through the rapids and the whirlpool next summer to Lewiston, Canada.

The motor boat industry, as mirrored by the 1910 show, is increasing by leaps and bounds. Already there are 50,000 motor boats in use in this country, and it is safe to say that by the end of another year this figure will be materially increased.

THE FIRST AMERICAN AERONAUTIC SHOW AT BOSTON.

The two general views of the Boston aeronautic show reproduced herewith will give our readers a good idea of how well-filled was the large hall at Mechanics Building with the machines of American inventors at the recent show. While a few of the aeroplanes exhibited were on the lines of some of the successful European models, most of them were patterned after American models, such as the Curtiss and Wright biplanes and the Pfützer monoplane. In one of our illustrations a monoplane on the general lines of the Bleriot (the "Morok") with the sliding wing tips invented by Pfützer instead of wing warping, appears in the foreground, while the large Antoinette type with triangular body and the smaller Bleriot type monoplane were both exhibited by the Scientific Aeroplane and Airship Company of New York. Both of these machines were constructed by Stanley Y. Beach.

Another general view of the hall shows the former of these two monoplanes in the foreground. Another monoplane of original construction (the "Burlingame") appears in the distance, while hanging from the ceiling is a biplane glider constructed and used by the students at Boston "Tech," and just below this another glider built by two boys after a description published in the Scientific American. The balloon "Boston," the club balloon of the Aero Club of N. E., is seen partially inflated in the center of the hall, while on the right-hand side are seen several balloon baskets, among them being that of Leo Stevens's small one-man balloon "Mercury" and the basket of a 160,000-cubic foot balloon capable of carrying 20 passengers.

The L. A. W. biplane and revolving-cylinder 2-cycle motor was one of the novelties of the show. This biplane was constructed somewhat on monoplane lines, there being a rectangular body extending out behind and carrying the biplane horizontal rudder for steering up and down. The motor was mounted on trunnions close in front of the main planes, which mounting makes it possible to direct the propeller upward slightly when the machine is running along the ground in order to rise. The new revolving-cylinder motor used on this machine is said to be one of the lightest motors of this type yet produced. It is soon to be put on the market in two sizes of 50 and 100 horsepower.

Besides the aeroplanes shown in our photographs, there were numerous other full-size machines. Most of these were described in our last issue. A Farman machine like that used by Farman at Brighton Beach in 1908 was put on exhibition when the show was half over. This machine was the only aeroplane said to have made a short flight previous to the opening of the show.

THE UNBALANCED BULLET.

(Continued from page 203.)

based, indicated plainly that the cause, so simple after discovery, was not even surmised. Their attempts to reduce it were based upon the theory that the blast of powder gases at the muzzle, or some condition of the rifle bore at the muzzle, was responsible for this apparent sudden change in direction of the bullet's flight at this place.

Persistent screen shooting and continued elimination of errors that were

(Concluded on page 211.)

(Concluded from page 210.)

known, indicated clearly that this X error was not the only error. Another cause was at work which added to or subtracted from the X error, and while experimenting for this the author designated it the "Y error."

He had known for years that tipping bullets make a spiral flight as they pass through the air. E. A. Leopold determined the diameter of some of these spirals several years ago. It was generally believed that a bullet often makes a spiral flight over the range, and the cause of this Y error at the target seemed to have some connection with this spiral in the air, which nearly all unbalanced bullets describe. The author's own screen shooting exhibited clearly the diameter of many of these spirals and the distance from the muzzle at which the spirals commenced. He found the cause of the Y error to be as simple as the cause of the X error.

The X error spiral ends at the muzzle, while the Y error, in the air, commences about 12 feet from the muzzle. The bullet makes an apparent change in its direction when it leaves its X spiral at the muzzle, and it makes another change in its direction when it goes into its Y spiral. The resistance of the air upon a tipping bullet produces its air spiral, and the rigid walls of the rifle barrel produce the X spiral described by an unbalanced bullet in the bore. The pitch of the X spiral, or the distance of one turn of the spiral to the next, is the same as the rifle twist, which for a 0.32 caliber is about 12 inches. The pitch of the Y or air spiral is about 45 feet.

The diameter of the bore spiral varies from a fraction of a thousandth of an inch to several thousandths of an inch. The diameter of the air spiral varies from a few thousandths of an inch to 7/16 of an inch, depending upon the amount the bullet tips in its flight. The air spiral, of course, results from the fact that the tipping bullet does not point in the direction of its flight.

The causes of these two errors, X and Y, are the same in principle, but their positions are reversed. The workings and explanations by actual experiments, well illustrated, are set forth very elaborately by the author.

The following conclusions may be drawn from the book:

In careful rest target work, under favorable shooting conditions, the X + Y error at the 100 or 200-yard target is about 80 per cent of all errors. The X and Y results from the fact that the tangent of a spiral (c c) forms an angle with the axis of its spiral (d d), as may be seen in Fig. 3. The bullet as a whole makes a spiral flight while in the rifle, because it is unbalanced or because it does not lie central and straight with the bore. It makes a spiral in the air because it is a tipping bullet. It is a tipping bullet because it was unbalanced when it left the muzzle. The unbalanced bullet, with respect to the center of the rifle bore, is therefore the prime cause of its X and Y errors.

To overcome the error which is inherent in the rifle and its ammunition, the bullet, before being shot, must be a balanced one; that is, its center of gravity must coincide with its center of form. The powder charge must produce uniform pressure from shot to shot. The rifle barrel and ammunition must be so constructed that the projectile remains balanced throughout the entire bore.

To have a projectile start from the muzzle in the right direction, that is, in the line which forms the center of the bore, the entire bullet just as it leaves the muzzle must be symmetrically balanced around the line of fire. Any reasonable rifleman would admit this last statement. What the author's work has disclosed, however, is to point out clearly the fact and its importance, and to show mathematically that practically the whole error at target attributable to the modern rifle and its ammunition originates in the unbalanced projectile.



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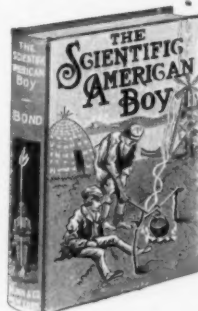
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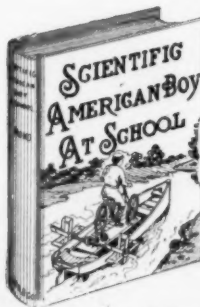
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